PUBLIC WORKS

An Engineering and Construction Journal

City County State

VOL. 63 FEBRUARY, 1932 NO. 2

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That "Brain Teaser"

Solutions of the courier problem, which was published in our January issue, have been received from a great many of our puzzle and problem enthusiasts. It isn't possible to acknowledge all of these solutions direct, nor to give the names here of all of those who solved the problem correctly. Honorable mention for prompt, correct and clear solutions is due the following:

Edwin M. Brady, city engineer, Elkhart, Ind.
Walter S. Wheeler, city engineer, Dover, N. H.
H. E. Brown, County Highway Engineer, Columbia, Mo.
K. W. Grimley, Birmingham, Alabama.
E. R. Dike, City Engineer, Jackson, Tenn.
S. L. Moyer, consulting engineer, Montevideo, Minn.

Solutions are still reaching us in nearly every mail. The problem was:

Infantry marching in column 20 miles long. A courier starts from the rear, delivers a message at the head and returns to the rear, which is then at the point where the head of the column was when he started from the rear. How fast and how far did he travel and what was the speed of the column?

Answer: The rate of the courier is 2.4142+ times the rate of the column. The courier travels 20x2.4142+ = 48.284+ miles. The absolute rate of the column is not a factor in the solution, but its rate is 0.414 that of the courier.

A Super-Teaser:

Try this one: A number ends in the figure 2. Move the figure 2 from the end to the beginning of the number. The number is now just twice as great as the original number. What was the original number?

A hint to would-be solvers. Don't try to do it mentally. Get a large sheet of paper—yes, several sheets—and go after it with all the mathematics at hand. It can be done. Mr. Folwell did it in 15 minutes by working out a formula for it.

And by the way, if you solve this *too* quickly, do the same thing with a number ending in 9. You'll be surprised.

Prize Winners:

First prize for the best problem (the contest was announced in our December issue, page 13) goes to Benjamin Eisner, of Taylor & Eisner, consulting engineers of Newark, N. J., for the number problem just above. R. H. Corey, Salem, Ore., gets second prize for a land-division problem which will appear in an early issue. Jerry Kavanagh of Chattanooga, Tenn., gets third prize for the courier problem published last month; A. A. Merrill of Cresco, Ia., fourth prize.

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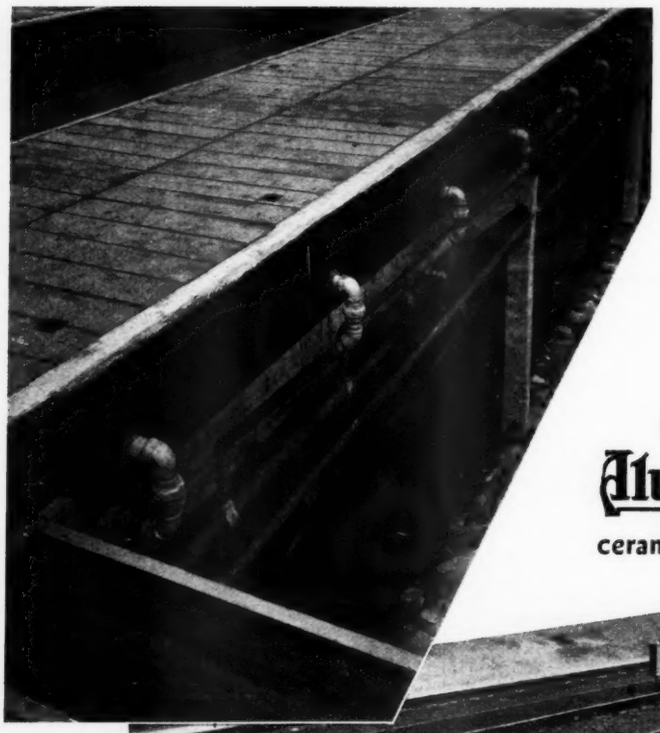

For Activated Sludge Sewage Disposal Plants

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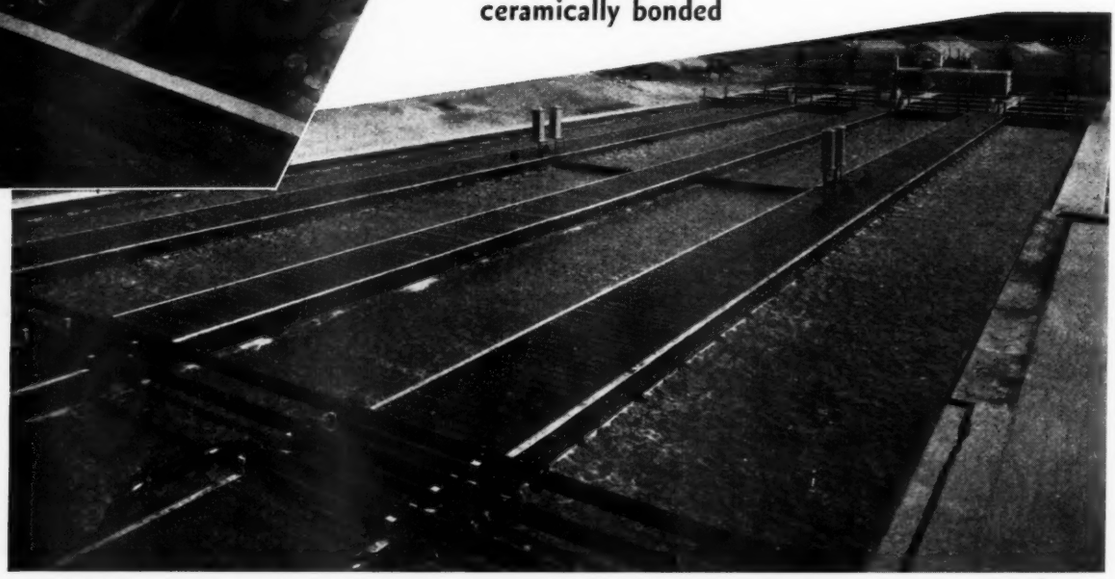

Views of a prominent activated sludge plant. Upper: Close-up showing arrangement of tubes. Below: General view of tanks in operation.

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PUBLIC WORKS

CITY COUNTY STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 63 February, 1932 No. 2

General view of sewage treatment plant at Grand Island, Nebraska.

Sewage Disposal Plant at Grand Island, Neb.

By F. M. Veatch

With Black & Veatch, Consulting Engineers

GRAND ISLAND, Neb., is located on the Platte river, but the main channel of the river is so far out that six miles of outfall sewer would be necessary to reach it, and the land is so flat that it could not be reached by gravity; moreover, the main channel is by no means permanent and none of the numerous minor channels offer sufficient dilution for untreated sewage. It was estimated that continuous pumping of the sewage to reach the main channel would cost more than operating a sewage treatment plant. Therefore such a plant seemed desirable both for financial reasons and to prevent pollution of the river.

For a number of reasons it was advisable to locate the plant on a site very near to the built-up section of the city and therefore appearance and odor control were of unusual importance. A high degree of purification was essential because the stream receiving the effluent offers practically no dilution. To meet these requirements called for a plant which is one of the most complete in the west, and such a plant has just been completed.

This plant comprises screening, settling, activated sludge treatment and digestion of the sludge. It was designed to treat the sewage from a population of 25,000 (the population by the 1930 census was 18,041) and provision is made for enlargement.

A mechanically cleaned bar screen with half-inch openings is provided, the automatically removed screenings being discharged onto a sloping floor for drainage and then burned in an incinerator fired by gas from the digestion tank. Since this is the most offensive part of the process, the screen and incinerator are housed in an extension of the pumping station.

Pumping is necessary to provide the head required, and motor-driven centrifugal pumps of the non-clogging type are provided, housed in a substantial brick building which, for both appearance and cleanliness, is lined inside with glazed tile of a light buff color.

The screened sewage first passes through a grit chamber and then enters a preliminary clarifier with a capacity of approximately two hours' flow. Here rotating plows sweep the sludge to a central hopper, from which it is pumped into the sludge digestion tank, while a skimming device removes the scum into a drainage sump from which it may be removed for incineration.

The digestion tank, a remodeled Imhoff tank, is covered and fitted with gas-collection domes and heating coils, the gas being used for incinerating screenings and the remainder burned under a hot water boiler whereby the temperature of the digestion tank is maintained above 70° F.

There are eight sludge drying beds, equipped with

a system of overhead carriers for removing the dried sludge. This will be disposed of for fertilizer as far as possible, the remainder being used for filling around the plant.

The activated sludge tanks, four in number, are of the compressed air spiral flow type, with a combined capacity of approximately six hours' flow. The activated sludge is reaerated in a small tank before being applied to the entering sewage; the amount so applied being regulated by an adjustable weir set in the discharge line of the activated sludge pump. Compressed air is furnished by three motor-driven rotary blowers of the positive pressure type. These, the sludge pumps, hot-water boiler, air filters, weir meter and other auxiliary equipment, together with office and laboratory, are located in a fireproof brick building.

The effluent of the activated sludge tank enters a final clarifier circular in form with central inlet and circumferential overflow weir, having a capacity of approximately two hours' flow, which is provided with sludge concentrators like those in the preliminary tank. The effluent from this tank passes over a measuring weir and the discharge is indicated, recorded and totalized by a weir meter located in the laboratory.

The plant cost approximately $140,000. It was constructed by the Chambers Construction Co. of Lincoln, Neb., under the supervision of Black & Veatch of Kansas City, Mo,. who also designed the work.

Taxpayers Responsible for High Refuse Collection Costs

The city manager of Hinton, W. Va., Hume K. Nowlan, through his monthly bulletin, continues to demonstrate how a record of facts and figures, mimeographed for a limited local circulation, can be made readable, and probably read, by a few drawings and a clear, non-technical and terse style of writing. (We referred to this bulletin in our issue of August, 1930.)

In the bulletin for January, 1932, Mr. Nowlan devotes a considerable part of the total four pages to refuse collection. In order to reduce the city's expenses, one rubbish collection truck, with its crew, was laid off and the interval between collections lengthened from seven days to ten. Complaints poured in, and a survey of conditions was made. This revealed that more than half of the premises in the city were without proper and adequate garbage, rubbish and ash receptacles. Most houses use wooden barrels, boxes and even paper containers for ashes instead of the standard steel ash can with handles and cover. Similar conditions obtain as to rubbish. But the greatest difficulty is in connection with garbage. This should be placed in a metal pail of approximately five gallons capacity, equipped with a carrying bail and close-fitting cover; instead of which, collectors have to handle it in small cans, lard pails, dish pans, and sometimes plain paper bags.

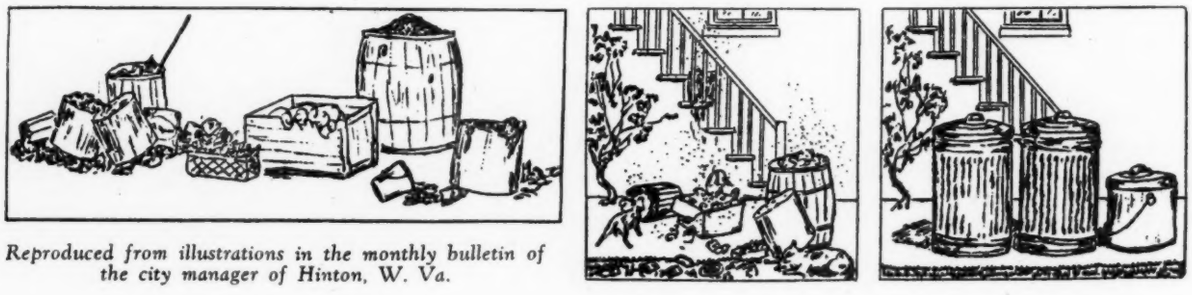
This has resulted from "the city maintaining a much too efficient and accomodating collection and removal service for the past few years. We have, by too frequent and uncomplaining service, allowed many to expect an almost personal, instead of public attention to this phase of modern housekeeping. The remedy lies in enacting an ordinance which prescribes that all premises be equipped with adequate and proper receptacles for ashes, trash and garbage. Enactment of the proper ordinance will enable the sanitary department to reduce operating costs by obviating the necessity of many unnecessary trips from house to truck thus speeding up waste removal. If this can be brought about, there is no doubt but that the former frequency schedule can be restored and maintained with the reduced personnel and equipment now operating."

And this is not the only city or the only way in which taxpayers are themselves largely to blame for high costs of municipal service.

Incinerator Serves Three Communities

The village of Pelham Manor, N. Y., on November 11 placed in operation a refuse incinerator which serves two adjacent communities also. This plant, which is located in an industrial zone just south of the Boston Post Road, consists of two furnaces, one having a capacity of fifty tons of mixed garbage and rubbish and two charging doors, the other a single unit of twenty-five tons capacity, built by the Pittsburgh-Des Moines Company at a cost of approximately $55,000. The present load on the plant is being handled in about eight hours and no storage of garbage is required. It is operated by three employees working under the direction of Thomas Dooley, street superintendent.

The plant also burns the garbage and combustible rubbish of the villages of Pelham and North Pelham, under contracts on a per capita basis, collectors of those two adjacent villages delivering to the incinerator.



Reproduced from illustrations in the monthly bulletin of the city manager of Hinton, W. Va.

Equipment for Constructing and Maintaining Low-Cost Road Surfaces

A most comprehensive and unusually instructive report made last month to the American Road Builders' Association was that of the joint committee (with the Am. Ass'n of State Highway Officials) on Equipment for Construction and Maintenance of Low-Cost Road Surfaces. This committee consisted of three state highway department engineers—John D. Waldrop, North Carolina; Ray Lindsay, Oklahoma; and J. E. Lloyd, Wyoming; two manufacturers—W. B. Greene, Barber-Greene Co., and H. S. Griner, J. D. Adams Co.; with C. N. Connor, Am. Road Builders' Ass'n, as secretary. The report is quite long, although very concise. It first describes the five classes of low-cost roads; then discusses equipment for construction and for maintenance, followed by recommendations on equipment. Addenda give, in tabular form, information received from 40 states; also a representative statement by a state highway official and another from one of the 38 equipment manufacturers who furnished information to the committee. We have endeavored to give in the following article a summary of that part of the report dealing directly with equipment, made as brief as possible without omitting any important features.

EXPERIENCE has shown that low-cost road surfaces of acceptable quality and quantity are possible when constructed and maintained by modern equipment. The purpose of this report is to present the findings of a survey of practice and trends in methods, plant and equipment used on such roads.

The matter is presented as it applies to construction and to maintenance of each of the five classes of low-cost roads, viz: Untreated surfaces; non-bituminous surface treatments; Bituminous surface treatments; Bituminous road mixes; Bituminous plant mixes.

Equipment for Construction

Equipment for Untreated Surfaces

Preparing aggregates by crushing and screening in portable *crushing and screening plants.* Sandclays, many sand-gravels, clay-gravels and other materials loaded directly from pit by *power shovel, scraper* or *loading device* do not require crushing plants.

Portable crushing plants of lighter weight and greater capacity than now in use are desirable.

Hauling to road by *trucks.*

Equipment generally satisfactory.

Dumping and spreading by *blade graders, stone spreaders, chip spreaders* and special *tail gates* on trucks.

These are generally effective in improving quality of work and reducing costs, but high price of some types prevents their use.

Mixing on the road by *harrows* of disc type, spring tooth or spike tooth, and by *blade graders.*

Mixing equipment seems to be satisfactory.

Compacting of traffic-bound surfaces is commonly done by traffic, but the *sheeps-foot roller* has been successfully used to a limited extent. The ten-ton three-wheel *power roller* is extensively used for compacting macadams and stone bases.

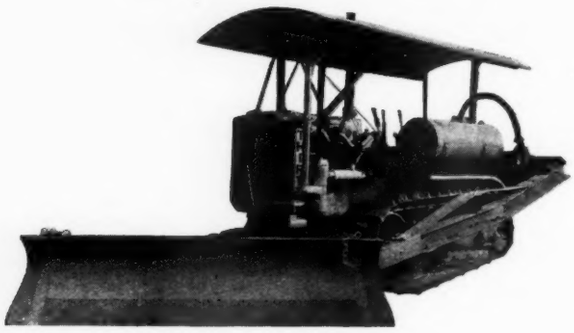
Early compaction by rollers is necessary in roller-bound types and desirable in traffic-bound. There is need for devices low in first and operating cost which will compact surfaces quickly and effectively.

Smoothing is accomplished by *patrol graders, drags* and *truck scrapers.*

Smoothing with heavy blade graders or long-base drags is desirable when surfaces are rough and corrugated and heavy cutting necessary. For light cutting and smoothing, patrol

Crawler loaders charging trucks with gravel

The Huber Maintainer



La Plant-Choate Road Builder

grader and drag commonly used. For maintaining light surface mulch, truck scraper is recommended.

There is need for a *scarifier* which will loosen surfacing without unduly disturbing the underlying and well-compacted base or mixing poor quality subgrade material with good quality surfacing.

Equipment for Non-Bituminous Surface Treatments

Construction much the same as maintenance of untreated surfaces on which a loose mulch of aggregate is spread, except that *calcium chloride* is applied to reduce dust and loss of aggregate. Calcium chloride is applied in flake or powder form from *lime spreaders, chip spreaders,* and specially designed machines, of which there are four on the market.

Lignin binders in solution with water are applied from *sprinkling trucks* or wagons.

Bags of chloride are commonly hauled in trucks to which spreaders are attached; additional supplies being brought by other trucks and the spreader attached to them. Rapidly moving scrapers, such as truck scrapers or power patrol graders or drags, are satisfactory for evenly spreading the loose surface mulch of fine aggregate on chloride-treated gravel roads.

Equipment for Dual Bituminous Surface Treatments

Construction on well-compacted and previously untreated bases include the following operations:

Sweeping and cleaning base course by use of *rotary brooms* and *blowers* attached to tractors or trucks.

A combined rotary broom and blower attached to a small tractor is an efficient unit.

Applying prime coat of bitumen by *power distributors.*

Prime coats are omitted if the base has been treated previously. Distributors are needed which can start and stop application of bitumen cleanly, without dribbling on road.

Applying light cover of chips or gravel if traffic is to use the road during construction; either by hand, or from truck.

Distributing second application of bitumen.

Spreading cover aggregate by means of *chip spreaders* attached to truck or tractor, or directly from truck.

Mechanical equipment for spreading is economical as compared to hand spreading from small stock piles—less aggregate wasted, more even distribution, speedier performance, Improvements in some types needed to prevent wheels of spreaders picking up aggregates.

Dragging the cover material when cold bitumens are used, or brooming them when the bitumen is applied hot. Light *drags* such as the broom drag are effective for smoothing the surfaces and coating aggregates with bitumen.

There is need for standardizing a long-base drag combining low cost with the best features of the present home-made drags and hones.

Compacting the surface by rolling with self-propelled *rollers.* Either light or heavy rollers are used as may be convenient.

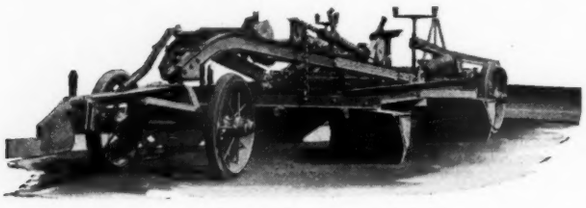
The lighter, up to 8-ton, are desirable for compacting the surface—are more mobile and less liable to crush cover aggregates.

Bucket *conveyors,* belt conveyors and *hoppers* attached to sides of cars are good to reduce cost of unloading aggregates as compared with unloading by hand.

Portable *heating units* of reasonable size with boilers which require little water are good for heating bituminous materials.

Multiple-Blade Drag

Broom Drag



Galion Mixing and Leveling Drag

Equipment for Bituminous Road Mixes

These are classified as graded aggregate and coarse aggregate types. The former has, as its principal operations, loosening the existing surface; harrowing, mixing and spreading untreated aggregates; applying bitumen; mixing by harrowing; mixing by blading; shaping and smoothing; compacting.

(Continued on Page 56)

Rock-fill Dam Supplemented by Welded Rust-proof Steel Plate

By Jos. C. Coyle

AT the close of the working season of 1931, the Penrose, Rosemont, dam of the Broadmoor Hotel Company of Colorado Springs, Colorado, in the mountains near that city and 9,665 ft. above sea level, was approximately one third completed. From the viewpoint of the engineer and contractor, the project is of special inerest because it is said to be the first rock-fill dam on which electrically welded copper-bearing steel sheets have been used on the upper face of the dam to make it impervious.

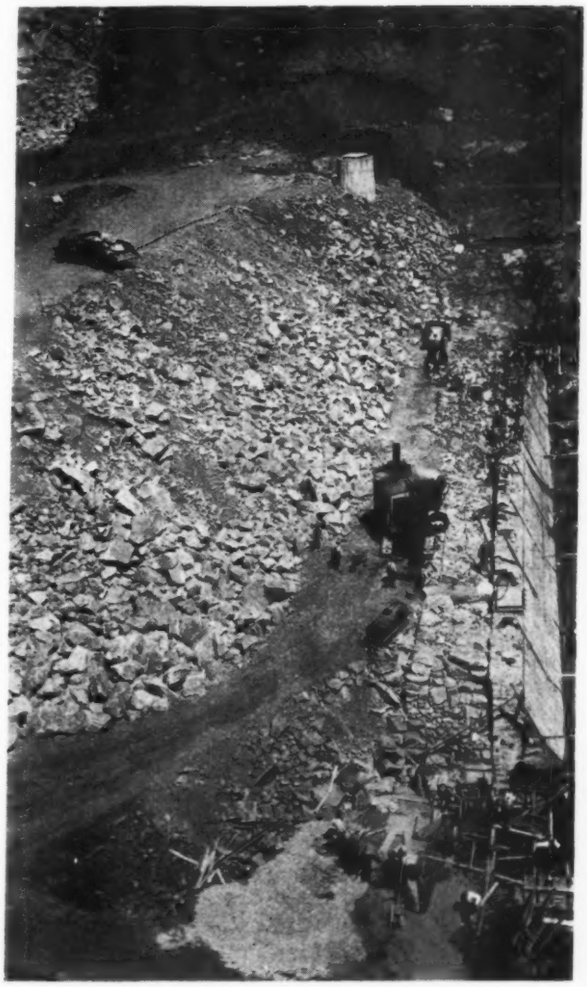
The dam is 270 ft. long at the bottom and will be 520 ft. long at the top, and will impound approximately 1200 acre-feet. The dam proper is 100 ft. high from the foundation, is 206 ft. thick at the bottom and will be 16 ft. thick at the top.

The entire base of the dam was excavated to bed rock, which was about 20 ft. below the surface at the north end and 55 ft. at the south end—approximately 80,000 cubic yards of excavation. Many large boulders, imbedded in the waste dirt, had to be drilled and blasted. The material was loaded into trucks, using a 1½-yd. Bucyrus-Erie and a ¾-yard Erie shovel, both steam machines. A cut-off trench at the upper side of the dam was blasted out to a depth of 12 ft. and 6 ft. wide and filled with concrete. In excavating this, very short holes were drilled, to avoid shattering the walls of the trench. Exploration of the dam site proved it to be a very tight formation, requiring only about 150 sacks of grout in 84 holes, drilled in staggered rows and grouted in at 120 pounds pressure.

Waste dirt from the original excavation was banked at the lower side of the dam to a depth of 35 ft. and a width of about 200 ft. Back of and supporting the steel plate is a rubble masonry wall, set in cement, 11 ft. thick at the bottom and 3 ft. thick at the top. Back of this is a strip of hand-placed stone from the quarry near by, which is 11 ft. thick at the bottom and 4 ft. at the top. The remainder of the dam is rock fill, hauled in trucks from the quarry and dumped in place.

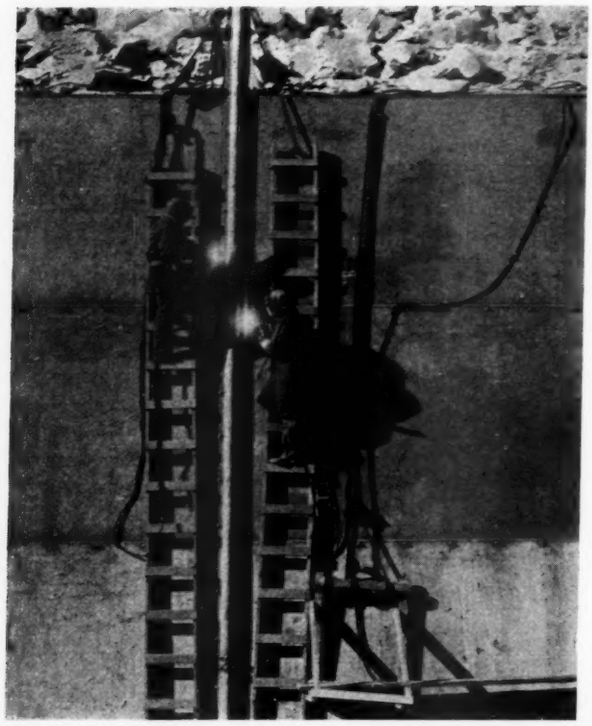
Approximately 2000 yds. of concrete of all classes, will be used in the dam, with 3756 pounds of rod reinforcing in the toe of the dam and in the outlet tower. This tower is 8 ft. in diameter inside, with walls 30 inches thick at the bottom and 10 inches at the top, and a concrete covered control house is built on the top of it. Aggregates used in the concrete work consist of gold bearing crushed stone from mills at Cripple Creek, 20 miles away, and sand hauled from Colorado Springs, a distance of 30 miles. A ½-yd. Koehring and a ¼-yd. Wonder mixer were used in preparing the concrete and mortar. A Myers 4-in. pump, with Fordson power, furnished water for all purposes.

The quarry which furnishes stone for the fill is approximately 130 ft. high and 250 ft. wide. The face is blasted down in benches, with holes drilled with Gardner-Denver jackhammers to a depth of about 20 ft. About 35 holes are blasted at a time, using Dupont 40 percent quarry dynamite and firing with a Dupont electric machine. Air is furnished at the quarry by three 310-ft. Sullivan portable compressors. A Sullivan oil forge and an Ingersoll-Rand sharpening machine are used in sharpening steel. The 1½-yd. shovel is used to load the stone into three 5-ton White and two 5-ton Mack trucks, which dump onto the fill.



General view of the dam during construction.

The steel sheets, as well as the bolts and welding rod with which they are joined, contain a percentage of copper which is said to be enough to prevent deterioration from rust. The sheets are 240 inches by 100 inches. Those in the bottom tier are ⅜ inch thick; the next five tiers are 5/16 and the upper five tiers ¼ inch. The plates lap, and are bolted together with a bolt spacing of 18 inches; all bolt heads, as well as the seams, being electric welded, using a General Electric and two U. S. L. portable machines. Space



Above: Welding the cover over an expansion joint. At rght: General view of the dam at the end of the 1931 season. Quarry, at left background. Below: View of part of the pipe line.

for bolt heads is provided by wood strips inset in the face of the dam, which is covered with 2 inches of cement plaster, after which the strips are removed before the plates are placed.

The plates are hoisted into place with a hand crab and are supported every 40 ft. on 6½-inch tee beams. At every other plate an expansion joint of 2¼ inches is left between the sheets, which are anchored to the wall by drilling holes in the latter and inserting ¾ inch split anchor bolts, with a nut and large washer. The split bolt is driven into the hole on a wedge shaped key to hold it in place. The expansion joint is made impervious to water by covering it with a half cylindrical steel shell welded into place, one edge to each plate, with fillets equal to the thickness of the plates.

Outlets through the dam are of steel pipe, one 14-inch pipe for water to the Broadmoor and a 24-inch pipe to by-pass water rights held below the dam. Double valve emergency control is provided on each outlet.

Water is taken from the East Beaver Creek on the west slope of the Pikes Peak range and diverted to the east slope and thence to Broadmoor, where it will be used for all domestic purposes in the hotel, as well as in private homes in the Broadmoor townsite and for irrigation of lawns and golf links.

Twelve miles of pipe line is being constructed to connect the dam to the Broadmoor. Ten miles of this will be 10-inch and two miles 13-inch steel tube, with Dresser couplings. The line will require seven 5 x 7 ft. tunnels, the longest of which will be 1150 ft. A Gardner-Denver portable compressor and jackhammers of the same make are being used in the tunnel work.

Pipe is hauled from Colorado Springs with 3-ton Mack trucks and trailers and distributed along the right of way. Being a drainable line, with no sags, there is no danger from freezing in winter and it is not necessary to cover the pipe deep. The trench in the valleys is dug with a Caterpillar "30" tractor. A Bucyrus-Erie ½-yd. gas shovel is used to excavate the shelf for the pipe line around the mountains. In one place it was necessary to blast the shelf out of solid rock for a distance of 2000 ft. The project is to be finished by September 1st, 1932, at a total estimated cost of $600,000.

Spencer Penrose and Charles L. Tutt are executives of the hotel company. Specifications for the dam were prepared by H. I. Reid, consulting engineer, J. H. Sanford is engineer in charge of construction, and Edward H. Honnen is the general contractor —all of Colorado Springs. Frank P. McKibben, consulting engineer of the General Electric Company, prepared specifications for the steel work, which was erected by the American Bridge Company.

Effect of Construction Equipment in Compacting Highway Embankment

EMBANKMENT, whether for highway, reservoir or other purpose, should be compacted to what is practically its final density before it is put into use. The method most commonly used for compacting is distribution of the fill in layers of a uniform depth of a few inches and consolidating each layer by means of wheeled equipment of some kind, either rollers used for this sole purpose, or the vehicles used for bringing the embankment material—generally both.

The effect of such equipment in compacting was reported upon by a committee of the American Road Builders' Association, of which the chairman was W. A. Blanchette, highway engineer, U. S. Bureau of Public Roads. This committee classified the vehicles employed as follows:

(1) *Wheel Types.*
- (a) Rigid wheel with steel tire.
- (b) Rigid wheel with resilient tire.
- (c) Rigid wheel with projections or feet (the sheep-foot roller).

(2) *Crawler Types.*
- (a) Crawler with bottom track rollers.
- (b) The truss wheel.
- (c) The Lynn type crawler.

Class 1-a includes 3-wheel rollers, tandem rollers, wagons and chariots, some of very great size and all used at low speeds. The typical illustration is the power driven 3-wheel roller. The difference, if any, in compacting effect of the free and the driven wheels is unknown, which uncertainty also applies to size of wheel and relationship of unit weight of roll to depth of earth layer being rolled.

Class 1-b includes all sizes of trucks and trailers with all kinds of rubber tires, from solid rubber to balloon and super-balloon. With the latter the impact is less, speeds higher, and area of contact greater and hence unit pressure less. The difference of the effect on compaction of free and driven wheels with resilient tires is unknown.

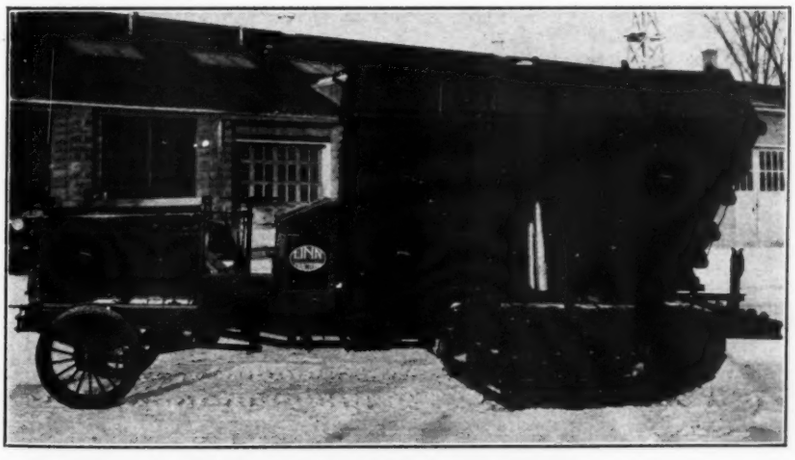
Class 1-c, the sheep-foot roller, and its modifications, consists of a roller with projections which give greatly increased unit pressure on very small areas of contact and a kneading action that is very effective in elimination of voids and consequently in consolidation; with the additional and chief advantage that the consolidation of the earth layer is from the bottom upward. The report mentions, as an objection to this type of roller, that, when rolling sticky material, the spaces between the projecting feet become filled with compacted earth, the effect thereafter being only that of a smooth roller of small unit pressure.

Class 2-a is the standard track type tractor. In general it will have a track contact with the ground of about 6′7″ and a shoe width of 16″, when the average weight of 10 tons would give a soil pressure of about 8 pounds per square inch. At the intermediate speed of 2.6 miles per hour, each track shoe will have continuous contact with the ground for a period of 1.7 seconds, and will have seven loads applied and removed by the passage over it of the front idler, the five track rollers and the drive sprocket; which loads are modified by the tension in the track and the friction of the track pins. In thin layers and with the proper degree of moisture, the movement of the particles of soil under the track shoes is sufficient to eliminate most of the voids in the mass and produce a satisfactory degree of compaction.

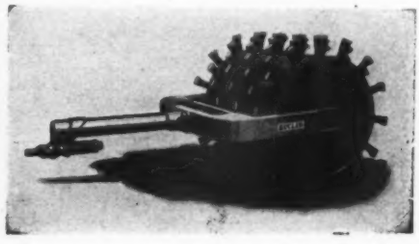
As the compacting action of the track type tractor is far in excess of that which could normally be expected from the unit pressure, the result must be due to a combination of: First, the very appreciable length of time that any track segment is in contact with the ground, thus overcoming the lag of the soil particles. Second, the effects of the impacts, small in amount but rapidly recurring, and the rock of the plates, as the track rollers pass from one plate to the next. Third, the shear caused by the draw bar reaction of the tractor.

In this class is included also those earth-carrying units which consist of a dump body mounted on a crawler tread which is supported throughout its length by arrangements of rollers.

Class 2-b, the truss wheel type of track laying equipment, is quite different. In this case, due to the inverted camber of the track and the truss action of the segments, the whole assembly acts like a wheel of very large diameter. The loads are applied continuously



Tractor equipped with Lynn type track.



Euclid tamping (sheeps-foot) roller.

and there is some impact due to the track wheels passing from segment to segment and these impulses occur two per cycle. There is no tension or shear in the track and the track pins turn with great freedom.

Class 2-c, the Lynn type track wheel, differs considerably from the first two forms in that the track element is perfectly flexible, the segments have a shorter length and the unit loads are considerably greater than in the tractor and about equal to those of the truss wheel wagon. The segments also have a horizontal reaction on the ground since the track is the propelling element of the vehicle. The small track rollers impress on each segment of the track a certain impact six times per cycle. These impacts, though small in amount, are applied very rapidly and are not modified by track rigidity or tension.

The committee makes no definite report on the results, either individual or comparative, of the use of any of this equipment, but rather outlines the information needed to make a study of such results, mentioning the following essential points:

(1) The depth of earth layer through which the various types and sizes of hauling equipment are effective for consolidation.

(2) The time lag of soils under pressures applied for compaction.

(3) The actual movement of soil particles under various types of hauling equipment.

(4) The effect of drawbar reaction or traction shear of both wheel and crawler units.

(5) The effect of wheel diameter and speed of rigid wheel equipment.

(6) The influence of flat, convex or spherical tips on sheep-foot rollers.

"A knowledge of soil characteristics is of prime importance in determining the most economical method of compaction. The work done on this subject by the U. S. Bureau of Public Roads and the subgrade classification adopted is extremely valuable."

In view of the many unknown factors in soil compaction, the committee recommends that certain field and laboratory investigations be made to clear up the moot points. It proposes to make an investigation by placing soils of contrasting colors in 2-inch layers in a pit 2 feet deep and 20 to 30 feet square, divided centrally by a glass partition properly braced to allow the units to be operated within an inch or so of the glass. In order to reduce the friction factor between the soil and the glass, sheets of colorless celophane will be used against the glass. As the pressure pyramid will be unrestrained on three sides and the treads or wheels operated very close to the glass, it appears that deflections and changes in the soils under test as observed through the glass will very closely approximate what happens under field conditions. The effects will be photographed with a movie camera, and the films run slowly in the projector should be very informative.

To the units under observation is to be attached a panel of wall board holding a level rod or equivalent lineal measure that will photograph easily, and an electric clock with the third hand extended to a length of 18 inches. With this clock, time intervals of 1/8 second can be readily determined.

It is believed that with this apparatus the following points in soil compaction can be observed and at least an approximate quantitative determination arrived at:

The relationship of weight-speed and size of roll to depth of soil layer affected, rigid-wheel equipment.

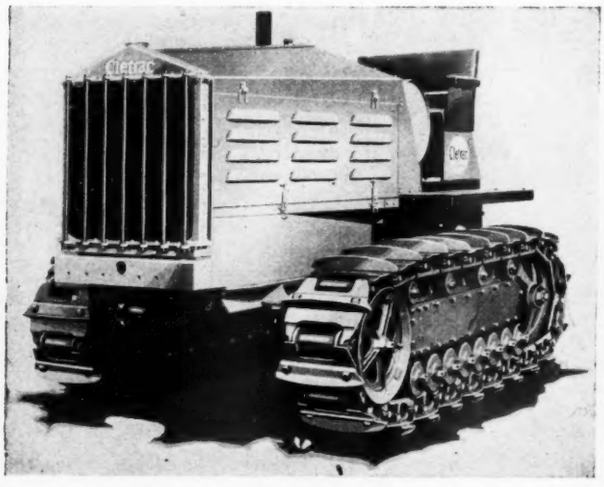
The effectiveness of resilient tire equipment in consolidation of soils.

The action of the sheep-foot roller.

The action of crawler equipment of all kinds.

The time lag of soils under process of compaction.

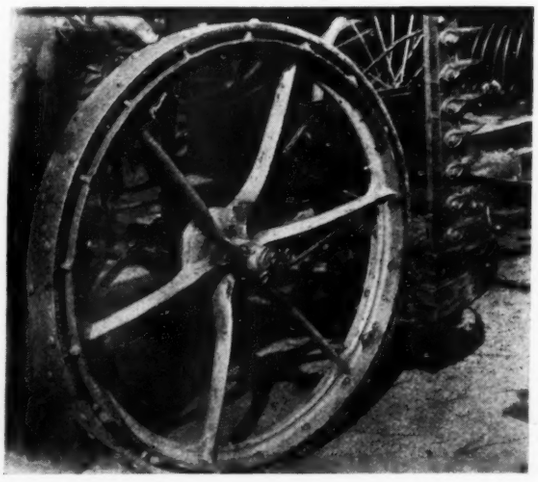
The effect of various moisture contents, within limits of soils.



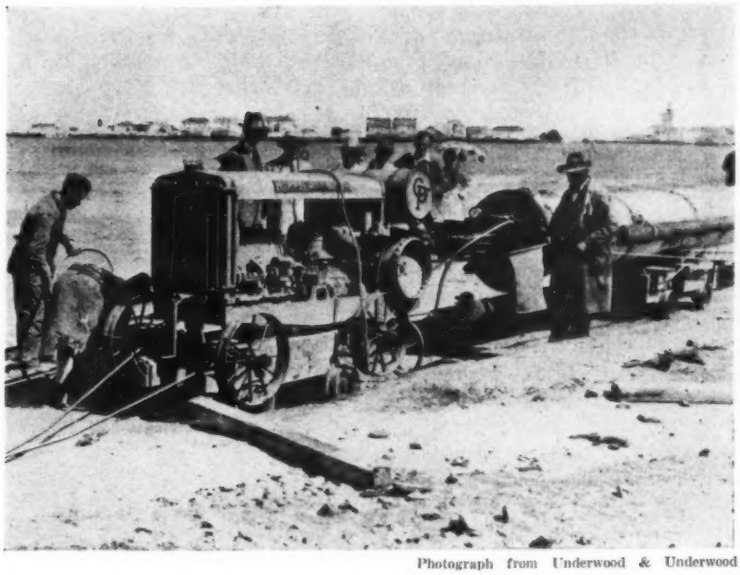
Crawler with bottom track rollers.

Denver Prevents Mower Wheel Breakage

A number of mowers, drawn by horses or tractors, are used by the city of Denver in cutting weeds on parkings and along the edge of sidewalks. This work necessitates much driving over curbs, etc., and consequently there was a heavy breakage in mower wheels for a while. The solution to the problem proved to be the placing of a tire, or band of ½-inch steel around the original cast wheel, securing the band with several bolts, the heads of which partly take the place of the lugs in traversing slippery ground.



Twenty-Seven-Inch Steel Ocean Outfall Sewer in Africa



Photograph from Underwood & Underwood

SINCE about 1900 the sewage of Cape Town, Africa, has been discharged at sea level through a 33-inch cast iron sewer and this has resulted in increasing pollution of the beach. Sedimentation, chlorination and other treatments were considered but it was decided to carry an outlet into deep water and discharge crude sewage there from multiple outlets.

The contour of the reef on which the old outfall stands, taken in conjunction with its exposed position, rendered the extension of the pipes along the old line into deep water expensive and difficult. Preliminary investigations included the taking of many soundings, observation of the nature of the sea bed, and of weather conditions, current observations, and the consideration of such problems as those of dilution and wave pressure. A survey of the sea bed was made, which included the careful examination of the proposed line of the outfall sewer by a diver. A submerged valley was discovered, which had a gently sloping rock bed running at right angles to the line of the wave action and protected by a reef.

It was thought, from American experiences, that a depth of 30 feet for multiple outlets would give sufficient dilution; but as there would be relatively small additional cost to carry the outlet to 50 feet depth, this was done. Eight 6-inch outlets were staggered along the two sides of the last 170 feet of the pipe, and a terminal outlet was given twice their area.

The site of the outlet is subject to heavy storms, and the anchorage of the outlet was a matter of considerable importance.

In order to test the wave pressures, three solid concrete cylinders, each 2 ft. 6 in. high, loaded in the interior with scrap-iron and placed by a diver at a depth of 20 ft., where a maximum pressure of .21 ton per sq. ft. was expected, were used. Calculations were made in order to ascertain the wave pressures at which these cylinders would slide or overturn. The test cylinders were laid on March 8th, 1930, and were not examined until November 18th. When the diver's report was received it was found that the smallest of the three cylinders had moved 9 in. out of position, but had not overturned. This was equivalent to a horizontal pressure of between .16 and .19 ton per sq. ft. and well below the pressure of .21 ton allowed by the calculations that had been made. The greatest sea disturbance during the eight months had the code number 6, as against a maximum code number of 7 from 1924 to 1928 inclusive. As the stress calculations for the pipe line were based on a factor of safety of 5, this result was felt to be entirely satisfactory.

With regard to the anchorage of the pipe line, the first 400 ft. from the shore was cased in massed concrete, and the remainder was secured at distances ranging between 70 to 150 ft. with about a dozen concrete anchors deposited *in situ* around the pipe, shaped like the segment of a dome 4 ft. 6 in. high and 15 ft. in diameter. The position of each pair of anchors was arrived at by consideration of the beam or cantilever strength of the section of pipe between them under the maximum horizontal pressure for that section. Allowing for very weak adhesion of the concrete to the rock, it was computed that such anchorage would be able to resist both the wave pressures on the concrete itself and the loads transferred from the pipe.

The positions of certain ball-and-socket joints on the pipe line, required where changes of gradient occurred, were determined by the longitudinal section of the sea bed; for these it was necessary to find vertical support.

The submerged pipes in new outfall sewer are of mild steel, with a maximum length of 25 ft., fitted with flanged joints bolted. They are coated with 5-16th in. of bitumen on the inside, and have a double external wrapping impregnated with bitumen on the outside. They received a third wrapping of hessian impregnated with bitumen upon arrival on the site. Flanges and bolts are protected by a pad of bitumen poured into a sheet-metal mould. Finally, the whole pipe was wrapped in white material to protect it from solar heat.

The total length of steel main is 1,881 ft. It includes eighteen ball-and-socket joints, built into the pipe line at points where it is known that definite

change of grade exists in the sea bed. These ball-and-socket joints are made of cast steel and have a movement in any direction of 15 degrees.

The pipe line was erected on land and was floated into position. In order to test the launching track and to observe the action of the ball-and-socket joints, a section of main 180 ft. long was let gently down the track, and as the buoyancy of the pipe made itself felt the trolleys were hauled clear. As the section rose and fell with the not inconsiderable swell it was apparent that the flexible joint was functioning perfectly. The pipe was gradually hauled into position and was gently manoeuvred into an open concrete channel prepared for its reception, which ultimately formed part of the concrete casing with which the pipes were to be protected for the first 360 ft.

More elaborate arrangements were required for the launching of the remaining long section; a powerful winch was erected on the beach from which a cable was passed up one side of the pipe, being threaded through three pulleys fastened to a blank flange at the extreme end, and being carried down the other side of the pipe to a point where it was fastened to an eye-bolt let into the rock on the beach. The arrangement was such that it had the effect of pushing the pipe, doing away with the possibility of straining the ball-and-socket joints, as might have happened if the pipe had been pulled. At a distance from the shore of about 2,000 feet a barge was firmly anchored; a hand-operated winch was used on board the barge. From a framework constructed on the shore across the launching track a cable ran out to the barge which was used as a guide wire, and was kept as taut as possible. This section of the pipe was laid satisfactorily in ten hours. The heavy concrete anchors were then laid.

All sewage entering the sewer passes through stereophagus pumps, and the storm water is also passed through disintegrator pumps. It is therefore impossible for any large solids to pass through the outfalls. All storm water in excess of three times the dry-weather flow passes through the old outfall sewer.

The above is an abstract of a paper presented by Walter John Houghton and Hugh Churchill Mason before the African District of the Institution of Municipal and County Engineers of Great Britain.

Lighting Main Street, Salt Lake

Salt Lake City has recently installed new street lighting on Lower Main Street, which comprises some 112 Westinghouse Titan Luxsolites mounted on Giant Duplex cast iron brackets and equipped with 15,000-lumen lamps. Sixteen of the fifty-six standards carry one all-night and one midnight lamp and each of the remaining standards two midnight lamps. Current is supplied to the lamps by means of No. 6 bare hard-drawn copper wire, strung between poles, and with No. 6, 3500-volt insulated wire looping through the brackets to the lamp bases. All the former lamps, brackets and wiring were removed by the Utah Power and Light Company as the new ones were installed, the new lamps being so arranged that either an old lamp or a new lamp which replaces it was in operation for the regular period each night, so that there was no interruption of service.

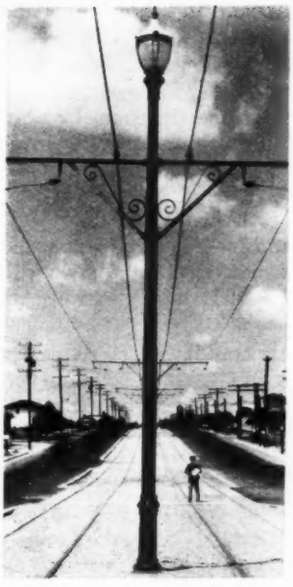
Day and night view of Main Street, Salt Lake City.

North Dakota's Highway Nail Picker

The North Dakota Highway Department began using a magnetic "nail picker" in August, 1930. From then until December 1, 1931, this picker operated 2,225 hours, swept 5,236 miles of gravel road, collecting 44,168 pounds of iron and steel, or an average of 8.4 pounds per mile swept. During the operating season of 1931—April 9 to November 19—3,087 miles were swept and an average of 8.4 pounds of metal per mile was removed; and of the total length of highway swept, 977 miles were swept a second time, yielding 4.6 pounds of metal per mile at this sweeping.

The cost of operation for the season was $1,234 operator's salary and expense, $403 for gasoline, $85 for grease, $431 for repairs and $39 miscellaneous. Allowing $844 depreciation gives a total of $3,037, or 75 cents per mile of sweeping done, or 98 cts. per mile of highway swept; or 10 cts. per pound of metal collected.

Only gravel roads are swept. Presumably asphalt-treated roads would hold metal objects imbedded in the surface.



Tubular steel combination lighting standards and trolley poles. Upright luminaires; rectilinear globes; 2-way Holophane refractors oriented at 30° from curb line. Spacing, 90 ft. Mounting height, 30 ft. Lamps, 10,000 lumen series.

Concrete standards in residence district, Milwaukee. Pendant luminaire equipped with Holophane refractor. Spacing, 300 feet. Mounting height, 32 feet. Lamp, 6,000 lumen series.

Cast iron standards in Biscayne Boulevard, Miami, Fla. Rectilinear globes and bi-lux refractors. Spacing, 100 ft. Mounting height, 18 ft. Lamp, 10,000 lumen series.

American Street Lighting Practice

Latest practices in financing, installing and operating street lighting systems and maintaining the street equipment were described in a paper befoe the International Commission on Illumination, at Edinburgh University, Scotland, by L. A. S. Wood, manager lighting section, Westinghouse Electric & Manufacturing Co., which paper we abstract briefly below:

AMERICAN street lighting may be broadly divided into two classes; namely, "utilitarian," in which illumination for safety and convenience is the prime factor; and "ornamental," in which appearance by day as well as the illumination by night is considered.

Financing Street Lighting

The provision of effective street lighting for protection is accepted by municpal authorities as a duty, and funds for this purpose are available in the annual appropriations for street lighting service. Such systems, except when municipal light plants are available, are installed, operated and maintained by the central stations under contract with the local authority, at service rates which are controlled by public commissions.

It is generally agreed that where ornamental systems are required, involving more expensive equipment with underground service, it is desirable that the cost of the installation be financed independently from the service rate. Under such a plan, the utility company's service rate is relieved from the fixed charges incident to interest and depreciation on the investment in the installation. In consequence, lower rates are established for service which are within the limits of the usual run of municipal appropriations. If such installations are financed by the utility company, the resulting rate may be too high for the municipality to finance the system out of annual appropriations for street lighting service.

There are several methods under which ornamental systems are financed, viz:

(1) A bond issue voted for the purpose by the taxpayers, authorized as an additonal tax but not financed out of annual appropriations for street lighting service.

(2) Assessment of the cost of the ornamental installation against abutting property owners. In this case, as in the case of the bond issue, the annual appropriation for street lighting service is relieved of the "fixed charges."

(3) Public subscription for the installation costs.

(4) Installed by the local utility company, in which case the "fixed charges" are added to the annual service rate.

Installations financed under Plans 2 and 3 are generally operated and maintained out of annual street lighting appropriations under contract with the utilty company. For installations financed under Plan 1, while this practice is general, the municipality in large installations occasionally purchases energy and operates and maintains its own system out of the annual appropriations.

In the earlier settled parts of the United States, along the Eastern seaboard, Plan 4 has been generally adopted and, because of the consequent high service rate for ornamental systems, the developments of this class of lighting in the Eastern States has not been as extensive as is the case in the Middle West and Western States, where the assessment plan has become general practice.

Maintenance

Considerable weight is given in the United States to the effective cleaning and maintenance of street lighting installations, and street lighting circuits are patrolled at night at regular intervals to detect outages and other defects in the service.

Maintenance is generally undertaken by the utility company as part of its contract with the municipality

but occasionally this service is performed by the municipality itself or by contract with street lighting maintenance companies.

Group replacement of lamps.—Much interest is being evidenced in group replacement of street lamps, undertaken circuit by circuit periodically, and usually in connection with the regular cleaning of the equipment, in contrast to the practice of replacing lamps individually as they fail. Such a plan is advantageous because of the elimination of the expense of special trips to replace individual lamps, and also because it tends to increase the efficiency of the system by replacing lamps before they have deteriorated in effectiveness.

Cost of street lighting.—The annual cost of street lighting in the United States is approximately $1.25 per capita. It is estimated that by an expenditure of double this amount all communities could make the streets of their cities as safe and convenient by night as by day.

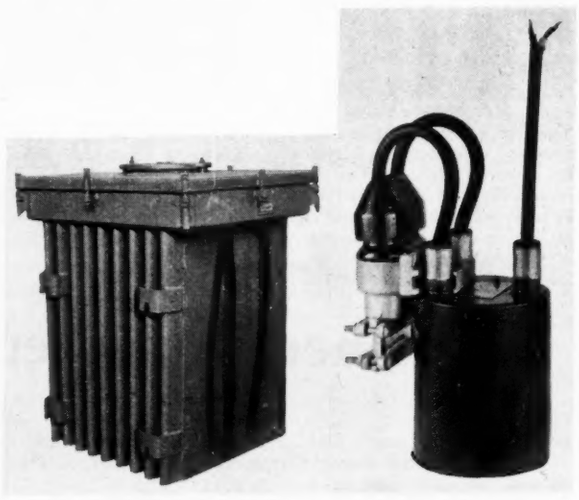
Many cities are spending considerably more than the average, such as St. Louis, Missouri, where an entirely new street lighting system has been installed under an eight million dollar bond issue, the entire central district and 68 per cent of the residence district having been completely relighted with an ornamental system served throughout from underground circuits. Milwaukee adopted a comprehensive street lighting plan 18 years ago and the first section was opened in 1915; since when the system has been developed until today there are over 19,000 lighting standards connected to the system; and in spite of the length of time that has elapsed since the original plans were made, additions have been coordinated with the earlier installations and larger lamps have replaced the original sizes without material changes in the system itself.

Whiteways.—The whiteways of America are of outstanding interest because of the intensive illumination provided for advertising purposes in addition to that required for safety and convenience. Among the most noteworthy are the following:

the assembly. Peepholes, for sighting lamp filaments to facilitate adjustment, are often provided in enclosing glassware and refractors.

Streethoods are constructed with bodies of cast aluminum or of cast iron with a porcelain enamel or hot galvanized finish. For a high voltage service (over 3,000 volts), such as obtains on the major part of the series circuits, the bodies are made of wet or dry process porcelain. The former is preferred, due to the higher voltage at which audible static is apparent. Streethoods, like pendants, may be equipped with porcelain enamel reflectors, enclosing glassware or refractors.

Utilitarian street lighting equipment is connected to "overhead" service lines and mounted on brackets or mast arms attached to the poles supporting the overhead distribution system. Utilitarian equipment



Moving coil constant current regulating transformer; pole type.

Isolating transformer with disconnecting pothead for mounting in base of standard.

NOTEWORTHY "WHITEWAYS" OF THE UNITED STATES

City	Street	Lumens per linear foot of Street	Type of Equipment
Chicago, Ill.	State Street	2,000	2-light gas-filled lamps
Detroit, Mich.	Washington Blvd.	1,930	5-light gas-filled lamps
Detroit, Mich.	Woodward Ave.	1,800	2-light gas-filled lamps
New Orleans, La.	Canal Street	1,200	3-light gas-filled lamps
Buffalo, N. Y.	Main Street	1,122	3-light magnetite arc
Ft. Wayne, Ind.	Calhoun Street	1,090	2-light gas-filled lamps
Seattle, Wash.	Metropolitan area	1,050	2-light gas-filled lamps
Cleveland, Ohio	Euclid Ave.	880	2-light gas-filled lamps
Salt Lake City, Utah	State Street	822	3-light magnetite arc
San Francisco, Calif.	Market Street	750	3-light magnetite arc
Cincinnati, Ohio	Central Parkway	742	Single-light gas-filled lamps (3 rows)

Utilitarian Equipment

Utilitarian street lighting equipment consists of "pendants" similar in general appearance to arc lamps, for use with the larger sizes of lamps, and "streethoods" for the smaller lamps. These are designed for use on series or multiple circuits and may be equipped with reflectors, enclosing globes with or without Holophane refractors, or with refractors only.

Pendants, when used with enclosing glassware are designed to be dust-tight as well as water-tight. Adjustable socket supports are provided to maintain correct light centre with varying sizes of lamps. Adjustable socket supports on several types of pendants are so designed that they may be adjusted from the outside of the case without removal of any part of

is also suspended over the centre of the roadway from span wires.

Lowering devices for utilitarian equipment are used to some extent but are not generally popular. Cleaning arc lamp replacement is for the most part undertaken from tower wagons.

Ornamental Equipment

Ornamental lighting standards are fabricated in cast iron, pressed steel and concrete. While a large number of cast iron standards are still being installed, the pressed steel and concrete standards are rapidly gaining favor and are being extensively used in the newer installations. Ornamental luminaires consist of one-piece globes and canopies of varying designs, which are often supported in metal frames. Globes

with deformed surfaces (rippled or rectilinear)* are used more extensively than the densely diffusing type. Ball globes which were once very popular have practically disappeared from service. Lanterns, also, are quite popular and have been installed in many cities, particularly where designs harmonizing with local conditions are required.

Holophane refractors are extensively used to control the light flux in utilitarian street lighting systems and also to a large extent on ornamental systems in residence districts. Asymmetric refractors are gaining in popularity and have proved satisfactory in producing uniform illumination at low operating costs.

Isolating Transformers

Isolating transformers, popularly known as "safety coils," are used extensively to insulate the luminaire from the high tension series circuit.

The most frequent source of trouble in series utilitarian systems occurs at the point where the overhead circuit is opened to carry the wires to the pendant or streethood. These wires, where lowering devices are used, are free to swing in the wind and thus become crystallized and cause an open circuit which puts the entire series circuit out of commission. To minimize this difficulty, an isolating transformer is mounted on the pole and its primary connected in series with the circuit. This transformer is so designed as to deliver the required voltage through its secondary circuit to the lamp, completely isolating the luminaire from the high tension circuit, the continuity of which is maintained at all times through the series winding of the transformer.

Cast iron and pressed steel standards, when subjected to severe impacts, are occasionally knocked down or broken, leaving the high tension cable exposed. To protect pedestrians and others, an isolating transformer is often installed in the base of the standard and connected in the manner above described. The transformer in this case not only isolates the luminaire from the high tension circuit, but in addition protects the standard from the base up.

Owing to the inherent strength of the centrifugally fabricated concrete standards to withstand impacts, isolating transformers are not recommended with this class of equipment.

Circuit control.—There are four methods of control for street lighting circuits in general use in the United States, viz:

(1) Time switches which operate individual lamps connected to multiple distribution systems or groups of lamps on series or multiple circuits.

(2) Pilot wires and relays which operate individual lamps connected to multiple distribution systems or groups of lamps on series or multiple circuits.

(3) Remote control through oil switches actuated by pilot circuits or by blinking a series circuit in which the oil switch is connected. An unlimited number of circuits can be cascaded in this fashion and control of an entire system obtained at the substation through a momentary interruption of the original circuit.

(4) Resonant control by the superimposition of high frequency currents on the secondary side of a distribution network which actuate relays controlling individual lamps or groups of lamps.

Modifications and combinations of the methods of control outlined above will solve practically any problem an operating engineer is required to undertake.

*"Rippled" and "rectilinear" are trade names for street lighting glassware, the outside surface of which is deformed to split the light rays without materially affecting their distribution. This type of glassware is generally finished with a light opalescent flashing which improves its day and night appearance.

Central and Truck-Mixed Concrete

"THE year 1931 has seen us launched upon an entirely new phase of concrete design and manufacture which should have a pronounced effect upon the upward curve of the concrete industry."

This statement was made in the report to the American Road Builders' Association by its committee on central and truck-mixed concrete, of which the chairman was Col. R. Keith Compton, director of public works of Richmond, Va. While this statement is general, the particular application, of course, was to the use of ready-mixed concrete on highway work.

Concerning such use, the committee last year learned, by correspondence with 42 state highway departments and 56 cities, that some of the engineers of these raised the following objections to central and truck-mixed concrete:

1—Segregation.

2—Damage to subgrade by hauling equipment.

3—The difficulty of the transfer of the product from the hauling unit to the subgrade.

4—Lack of control.

But the committee reported that it "feels safe in predicting that the year 1932 will see the engineer convinced that segregation in properly handled ready-mixed concrete has been eliminated; the difficulties with subgrade rutting and transferring of the product from the hauling unit to the subgrade rectified by mechanical equipment of proven adequacy; and the control of the mix, both in the central mixing plants and truck mixers, handled in a manner which will eliminate any doubt in the mind of the engineer as to the effectiveness of such control."

Concerning segregation, the committee said that the difficulty of this "has been definitely overcome in the operation of an up-to-date plant." While design of the hauling equipment has aided greatly in this, "the largest single item in overcoming this difficulty has been the careful preparation of the concrete, with particularly close attention being paid to the gradation of the aggregates and the consistency of the mix. Concrete prepared from carefully graded aggregates, scientifically proportioned and properly mixed in either a cental mixing plant or a truck mixer, can be hauled without segregation for a distance or length of time far in excess of the economic limit of such haul."

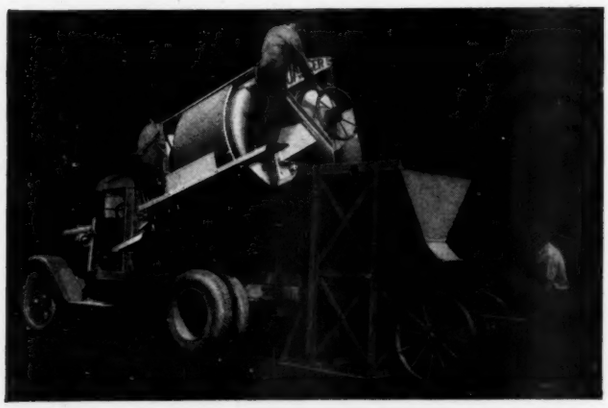
Items 2 and 3 are so closely related that they were considered together. Damage to subgrade resulted from standard pavers charged by material trucks. Ready-mixed concrete trucks weigh more than ordinary material trucks and so rut deeper, but the great difference is that, while with boom-and-bucket delivery

from a paver there is an opportunity to smooth out the ruts, there is no opportunity to remedy the rutting done by ready-mixed trucks before the concrete is placed. However, "on probably the vast majority of pavement yardage to be constructed, the subgrade would be of such type as would give little or no difficulty along this line. Again, the work may be so constructed as to pour the concrete from outside the forms, thus eliminating the necessity for the operation of trucks on the finished subgrade. Many pavements, particularly where the width is twenty feet or more, are being built in lanes; such construction permits, at all times, the pouring from outside the forms."

Rex mixer with hoist and spout.

Manufacturers are preparing to meet this objection by providing equipment for transferring the concrete from the hauling unit to the subgrade. At least ten, probably more, different designs of such equipment are in the process of development; although the investigator for this committee thinks most of these will be too expensive to be economical in combined first cost and operation. Some equipment of this type has been put in actual operation, and "It is practically assured that another year will see such equipment developed to a highly satisfactory degree."

There has been more advance during the past year in control than in any other single phase of concrete mixing. There is no question that, aside from the other known variables which occur in mixing a batch of concrete, the greatest of all variables is the percentage of surface moisture present in the sand and aggregates. Engineers are increasingly in favor of proportioning aggregate by weight rather than volume, and if accurate means could be devised for determining and compensating for the surface moisture, it would be possible and feasible to institute weight control of proportioning as a fixed method.



Jaeger truck mixer with hoist attachment.

However, "undoubtedly one of the underlying mental obstacles to the full acceptance of this method (use of ready-mixed concrete) was based upon the fact that an operation was being performed some distance away from the job which, if inaccurately done, rendered even the most rigid inspection at the job entirely useless. A method practically indentical in operation has been in use for the manufacture of hot bituminous mixes for many years and has been accepted without question."

More and more engineers are specifying concrete by ultimate strength rather than by proportions of ingredients, and ready-mix plant owners are naturally avoiding possibility of rejection by adding an excess of cement; which practice, of course, involves increased price. Moreover, concrete has been the only important building material which was manufactured on the job; and since jobs, sources of material and brands of cement all differ, as well as accuracy of proportioning and excellence of mixing, engineers have used a factor of safety based on 40% of the ultimate strength. If these uncertainties can be reduced sufficiently only to permit raising the allowable stress by 10%, enormous waste can be avoided. During the past year there have been developed and placed in actual operation improvements and refinements for control of the mix which it is believed will overcome these objections.

"Briefly summarized, improved control means better design, more economical design, better concrete, and 100% inspection; all of which put the concrete industry in a better position to defend itself against the ineviable encroachment of other materials when or where structures of equal strength can be supplied at less cost than that of concrete."

Alley Paving for Unemployment Relief

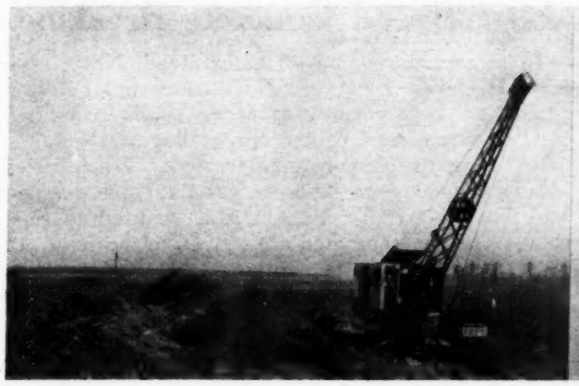
It is reported by the Portland Cement Association that only 85 miles of alleys were paved with concrete in 1931 as compared to 550 miles in 1927, which was the peak year. As most paving of alleys is done with concrete, this may be taken as indicating a falling off of almost 85 percent in this class of work.

To those who have experienced both paved and unpaved alleys, either as users, abutting dwellers or only occasional observers, the advantages of paving in promoting convenience, cleanliness, health and appearance do not need to be proved—they are self-evident. In fact, for cleanliness and health alley paving is even more important than street paving, because an unpaved alley is more commonly made a receptacle for rubbish and filth than an unpaved street.

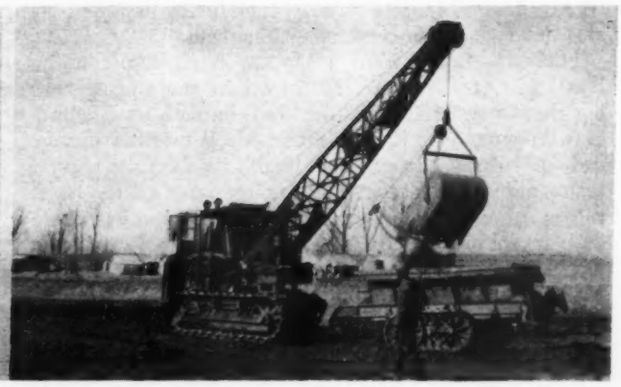
Any city which has unpaved alleys might well include these prominently in work selected for unemployment relief; beginning by cleaning them (which most of them will need), then grading (generally dished, with a gutter or drain down the center), and paving if the money can be obtained.

Water Rates Include Irrigation Charge

The water rates of Fresno, Calif., are, for the winter months (November 1 to May 1), $1 per month. The irrigation charge, effective May 1 to November 1, is as follows: Minimum charge, 50 cents, which allows for 75 square yards of lawn or garden; each additional square yard is ½ cent extra.



Dressing up the Levee with the Northwest. Bucyrus-Erie electric tower machine in distance.



Link-Belt Dragline loading Western wagon on the Harris subcontract.

Dirt Moving on a Mississippi Levee

QUITE a variety of equipment was used in a contract near Tunica, Miss., last year by H. E. Culbertson, contractor of Cleveland, O., and his subcontractor. The job, loop levee construction, involved 1,865,000 cubic yards of earthwork. The varying conditions involved in the work fully justified the variety of equipment employed. The price was 24.34 cents per cubic yard.

On one portion of the work, the contractor used one of the new Bucyrus-Erie electric tower machines with a 130-foot tower. This carried a 10-yard Bucyrus-Erie bucket, and worked over a span of 750 feet, taking dirt for the base section on the first trip, and then going back, with the head tower working on this base to complete the levee section. On another portion of this work, where the levee crossed over an old slough, dirt had to be brought from borrow pits some distance away. Here the contractor used industrial railway equipment.

A Northwest 1½-yard dragline was used at the borrow pit for loading the cars, and another Northwest was used on the levee for spreading the material dumped from the cars and finishing up the section. Two trains, each of fifteen 4-yard Western dump cars were used. Three locomotives were kept on the job—one 10-ton, one 12-ton and one 15-ton, all Plymouth gasoline driven.

D. G. Brown was superintendent for Culbertson on this job.

At the other end of the job from the railway work, a stretch of 1,000 feet of enlargement was sublet to R. P. Harris, tieing in the new levee to the old. On this work, Mr. Harris, one of the older levee builders, used quite different equipment. His compact outfit, personally supervised, consisted of a Link-Belt dragline with a 1¼-yard bucket, four Western 5-yard crawler wagons, hauled by "Best" tractors, and nine 4-up mule teams. This outfit worked two shifts a day (except the mules), lights for night work being supplied from a Fairbanks-Morse portable "Three" Home lighting plant. While Mr. Harris' equipment was not new, it was delivering with a minimum of lost time. The tractors, though they had been a long time on the river—four or five years, according to Mr. Harris—were going through their work without delay. Of the Western wagons, Mr. Harris said:

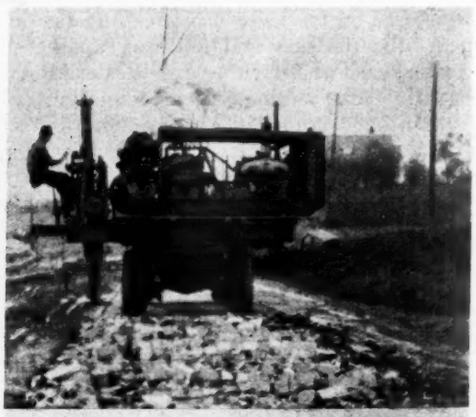
Mr. Harris, left, and Mr. Huffstetter, of the Memphis office, Mississippi River Commission.

This F-B portable plant furnished light on the Harris job.

"They have been run a year, mostly day and night, and never had five cents spent on them."

Dirt was taken from a shallow borrow pit on the land side of the levee, as shown in the illustration, by the Link-Belt dragline, and hauled by tractor-crawler wagon or the mule teams. While the former did, of course, the great bulk of the work, the mule teams aided in keeping the dragline busy all the time, filling in on the longer hauls, and in places where bad travel conditions might delay or slow up the mechanical equipment. Under the watchful eye of Mr. Harris, this outfit moved with precision and efficiency, and showed a minimum of lost time.

Thus on this contract, three different types of equipment were used, each in its place efficiently. Long hauls are generally best handled by industrial railway equipment. The tower machine is undoubtedly supreme in efficiency in its own field where sufficient dirt for constructing the maximum section can be obtained with 600 to 800 feet, though this new electric tower machine can reach farther if necessary. For the short section, involving a comparatively small yardage, the old levee builder with his compact and efficient outfit, operating under his own eyes, can still hold his own, at least.

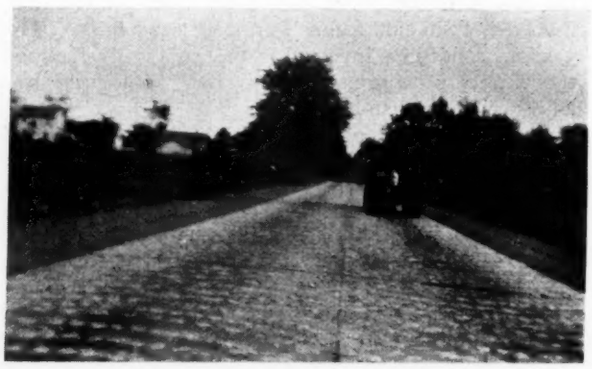


Above: Breaker operating, swung to side of truck. Below: Breaking pavement foundation for a pipe trench.

High-Speed Concrete Breaking

In the reconstruction of Essex Road, New Jersey State Highway 5, between Hackensack and Paterson, a new type of pavement breaker was employed by Geo. M. Brewster & Son, contractors of Bogota, N. J., for breaking up the old concrete pavement. When broken in this manner, the concrete lies flat, and does not interfere with traffic, though it is reduced to small shovel size and separated entirely from the reinforcement. On this job the equipment broke about 2,000 square yards in eight hours.

This same equipment (which was supplied by the National Demolition Corp., Nutley, N. J.) was employed by the Spiniello Construction Co., Newark, N. J., in opening a trench in Kearney, N. J., for water main construction. The concrete here was 10 inches thick, in two layers—a top layer of 4 inches and a bottom layer of 6 inches, reinforced. On this job, the breaker kept ahead of three power shovels removing the broken concrete. A feature of this demolition work was that service pipes only 6 inches below the pavement were uninjured by the impact. Also, the concrete adjacent to the trench was not injured.



Concrete pavement broken up but passable to traffic

This machine is mounted on a turntable on a 5-ton truck, and is operated by an air compressor which also is carried by the truck. By revolving the turntable, it has a range of width of one to 11 feet. It is also adapted to power tamping of trenches. The machine can strike 60 blows a minute, complete control of the breaker allowing the force of the blow to be varied according to the needs of the work, up to 18,000 pounds. The cost of the operation does not exceed that of a mounted 3-gun compressor.

Baltimore's Municipal Testing Laboratory

The city of Baltimore maintains a testing division which tests all bituminous materials and mixtures, maintaining a daily plant and laboratory control, for the construction and maintenance divisions of the Bureau of Highways, and for the Maryland State Roads Commission and the United Railways and Electric Co. The cost for this inspection in connection with about 730,000 sq. yds. of bituminous pavements, on a prorated basis, to the several departments and bureaus served, was 2.12 cents per square yard in 1930.

Sand and gravel are inspected for all city departments at a cost, in 1930, of 1.99 cents per ton.

Inexpensive Temporary Cable Bridge

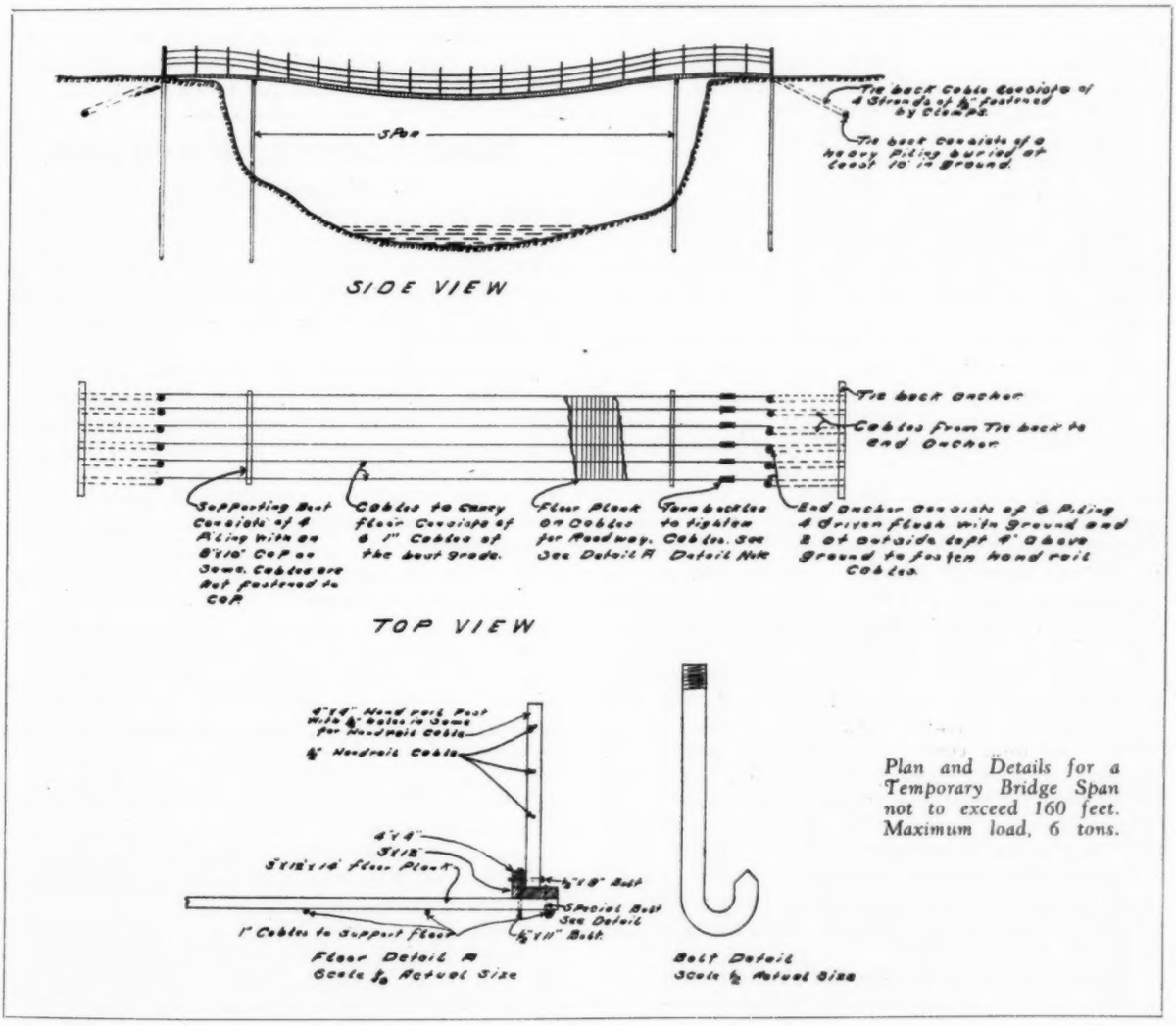
By W. P. Norris
County Engineer of Page County, Iowa

ONE mile north of Shenandoah, Iowa, a city of 6,000 population in the southwestern part of the state, a foreman and five men, in eight working days of ten hours each, built a bridge to replace one destroyed by flood and thus serve a local traffic which otherwise would have had to continue to detour ten miles in traveling westward. The bridge was intended to be temporary, until county finances would permit replacing this, and several others carried away by floods, with more durable ones. Also it was intended for local traffic only; but for approximately six weeks, during the rebuilding of a bridge on a near-by primary road, it carried the traffic of that road averaging 520 cars a day, with no noticeable effect except rapid wear of the floor.

The bridge is supported by six 1-inch cables laid parallel about 2½ feet apart, resting on the cap of a pile bent driven at each edge of the stream, and anchored to piles driven twenty feet or so back; which piles in turn are anchored to a "deadman" or tie back. The floor planks rest directly on these cables, being fastened to the two outer ones.

Of the six piles at each end to which the six cables are attached, the two outer ones were left standing about 4 feet above the ground and three cables of a hand rail were fastened to each. The other four piles were driven flush with the ground. Each cable was passed around a pile and fastened with a clamp, an iron collar made from a piece of automobile frame being placed around each pile under the cable to prevent the latter cutting into the pile. At one end of the bridge a 19½-inch turnbuckle was inserted in each cable so that it could be tightened and all the cables brought to the same level. To prevent the piles being pulled forward, each was anchored to a deadman buried at least 10 feet deep, by means of a 1½-inch cable.

The floor consists of 3 in. x 12 in. x 14 ft. fir planks, each attached to the two outside cables by means of hook bolts which pass through both floor plank and



Plan and Details for a Temporary Bridge Span not to exceed 160 feet. Maximum load, 6 tons.

View of completed bridge.

Looking across bridge.

guard; the latter being a 3 x 12 plank laid lengthwise of the bridge along each edge of the floor. On top of and along the inner edge of this plank is laid a 4 x 4, which is bolted to it, and to this in turn are bolted 4 x 4 handrail posts 4 ft. high, through which are threaded three ½-inch cables to form the guard railing.

The cost of this structure complete was $2,231.

Chicago Refuse Disposal

Chicago divides the refuse collected from part of the city into two classes, garbage and combustible matter in one receptacle and ashes and rubbish in another. This division is made in wards 20 and 25 to 30 inclusive, which include about 60% of the population. In the rest of the city the garbage is removed and dumped with the ashes and rubbish.

The garbage and combustible matter collected separately is weighed and burned in an incinerator. Although combustible matter is mixed with the garbage, 470 tons of coal were used in 1930 in burning 75,241 tons, or an average of 12½ pounds per ton of garbage, etc.

This 75,241 tons was collected in 65,941 loads, 4,113 loads by Mack trucks and 61,828 loads by Highway trailers. The cost of collecting and hauling to incinerator averaged $4.05 a ton.

This material is burned in what is known as the Goose Island incinerator. The amount so burned varied from a minimum of 2,845 tons in March to a maximum of 11,480 tons in July. The labor costs were the same, however, $13,936, but no coal was used in July (presumably because a considerable part of the excess collection was inflammable rubbish), while 11¼ tons was used in March. Except for January and February, when $1,240 was spent each month for repairs, electricity, supplies, gas, oil and gasoline, between $2,200 and $2,800 was spent for this item each month, an average of $2,262 per month for the year. The total cost for labor, fuel, repairs and supplies, superintendence and overhead, but including nothing for interest or depreciation, was $183,356. The cost per ton varied from a minimum of $1.45 in July to a maximum of $5.70 in March, the months of maximum and minimum collections; for the monthly totals varied only from $16,218 in March to $16,739, except for January and February when the labor costs were only 55% as much.

The per cent of residue or ash from the incinerator averaged 12.7% in January and February, and 20.3% the other ten months, reaching a maximum of 25.2% in December.

Of ashes and rubbish, with garbage from 40% of the population, there were collected 369,209 loads, 18,924 loads by teams, 89,790 by trucks and 260,495 by trailers. (Horses were used for collection, and the long hauls made by tractors and trailers in trains.) The team loads averaged 4⅓ cubic yards, truck loads 7¾ cubic yards, and trailer loads 5⅔ cubic yards. Of the amount so collected about 40% was delivered to pay dumps and the balance to loading platforms to be hauled by railroad to various locations.

The cost of collecting and hauling averaged 62 cents a cubic yard. The maintenance of dumps cost $113,416, and the cost of pay dumps was $764,588; giving a cost of 39 cents per cubic yard.

Black Concrete Pavements

By William E. Barker

In October, 1931, the Essex County, N. J., Park Commission laid 2950 feet of black concrete pavement 32 ft. wide. The pavement is 8 inches thick, the bottom 7 inches being a 1-2-3½ base course, while the top 1 inch, which is the only portion colored, is a 1-1½-2 mixture.

Eight pounds of black iron oxide was used per sack of cement. Specification for the coloring matter provided that it should be a commercial grade of black iron oxide consisting of not less than 5 per cent pure iron oxide ground to such a fineness that not less than 96 per cent would pass the 325-mesh sieve.

The iron oxide was batched by measuring 8-pound units separately into paper bags and adding one of these to the materials in the mixer skip for each sack of cement in the mixture.

A layer of base course concrete was spread to a depth of approximately 5 inches and struck off. Marginal steel and the hairpin bars used to reinforce the corners were laid on the concrete and then the remaining 2 inches were placed and struck off with a wooden hand screed. Mixing time for the base course was 1½ minutes. The base course was spread for a length of two 50-ft. sections, then the mixer was moved back and the drum was washed out. The colored top course was then mixed for a period of 2 minutes. It was struck off with a wooden screed, smoothed with a hand lute and then broomed.

Similar specifications were used in the construction of black concrete pavement in Englewood, New Jersey, and it was the satisfactory results of this work that led the Essex County Park Commission to use it.

THE EDITOR'S PAGE

Economy and Maintenance

Federal, State and county officials, and those of cities of all sizes from New York down to the small village, are being instructed to keep their expenditures down to a minimum or compelled to do so by budget allowances. In doing so, they naturally wish to carry on as many as possible of the projects included in a more or less definite program which they are following; also pressure may be exerted to secure the construction of certain projects of paving, sewer extension, etc.

But one thing public works officials should make sure of—that existing structures and plants are adequately maintained. The amount necessary for this should be estimated and irrevocably allotted to this purpose. The worst possible practice from an economical point of view is to allow what we have to lose its value in order that new may be acquired. If the money that should be spent in painting a standpipe to prevent rusting is used instead in extending the mains into another block or two of a residence development, the result may be considerable expense and inconvenience to consumers later due to repairing or rebuilding the tank because of its rust deterioration. A thousand dollars spent on paving a block of city street which should have been used to repair incipient holes in existing pavements may result in next spring's finding an expenditure of ten thousand necessary to restore the neglected pavements.

There are cases, of course, where maintenance involves new equipment. If the amount of water or sewage to be pumped has increased to the point where the pumps are working a large part of the time at rates approximating their limit of safe operation, proper maintenance of these pumps is impossible unless they be relieved by the addition of one or more new ones. If the refuse collection equipment is overloaded or every vehicle is used so continuously that there is no opportunity for keeping them in proper repair, economy and maintenance call for additional equipment.

Keeping the old up to a high state of repair and efficiency may not be so interesting to many as buying new, and it does not make so spectacular a showing for the official in the view of the uninformed taxpayer; but it is necessary for true economy and should be the aim of every conscientious official.

Location of Footwalks in Streets

In a report of the Regional Plan of New York and Its Environs recently made public, the statement is made:

"Apart from arcading as a method of providing space for pedestrian traffic off the open street, there is need for more attention to be given to the location and arrangement of walks for such traffic. It has become a convention that the pedestrian way shall always be on the edges of and parallel with the roadway. This convention has been an encumbrance to original design in laying out street systems. In shopping districts it is essential to have sidewalks adjacent to frontages and some form of narrow sidewalk is essential in residential streets, but the planning of Radburn, N. J., has proved that it is better to provide walks, in many cases, at the rear instead of on the street front of houses. In main highways of great width there should be a center walk as well as sidewalks.

"In commercial streets where the use of abutting property is mainly industrial, the sidewalk provision should be subordinated to the vehicular use of the street, namely, the loading and unloading of vehicles. It should be limited to what is required by uses of the buildings and a center walk should be provided for other pedestrians."

This last suggestion was made in January, 1916, by this magazine (then called "Municipal Journal") with the following comments: "The chief use of a warehouse street is to transfer heavy goods between the abutting buildings and trucks, and this requires that trucks back up directly to loading platforms or the building line. This requires that the pavement on the sidewalk space be such as to carry vehicles without damage and that curbs be omitted; and it interferes seriously with the use of the sidewalks by pedestrians. Such pedestrians as there are for the most part use the street not to reach these buildings, but as a thoroughfare, and in doing so are compelled to walk in the roadway. We can see no reason, except the thoughtless following in old ruts, why the roadway pavement should not be carried to the building line, and the sidewalk (or rather the footwalk) be located in the middle of the street. All uses of the street would be better served thus."

Ready-Mixed Concrete for Paving Work

Finishing machines have for several years been accepted as desirable for use in constructing concrete pavements, and, considering their success in this work, it seems strange that their use was not adopted at once in laying asphalt pavements. However, during the past two years the possibility and advantages of using such machines in asphalt paving work, modified to suit the different conditions, have been demonstrated and the use is becoming general.

But apparently concrete paving engineers have something to learn from asphalt paving practice. As stated on page 28, an obstacle to the acceptance by engineers of ready-mixed concrete is the fact that it is mixed away from the job, where the paving inspectors can not oversee it. But this is just what has been done for years in laying hot bituminous mix pavements, and the resulting product has been, it is believed, as uniformly satisfactory as has been the concrete turned out by portable paving mixers. Under certain conditions, especially for work in cities, there are considerable advantages in using ready-mixed concrete, which, we believe, far outweigh the disadvantage referred to, if in fact it is a disadvantage at all.

RECENT LEGAL DECISIONS

With Reference to Garbage Collection and Sewer Construction

By John Simpson

Exclusive Right to Collect Garbage Not a Franchise

Although the right of a city in the state of Washington under the police power to handle garbage itself or to provide for its being handled by private parties is well settled, the exclusive right to collect garbage in a city is not a "franchise," as that term is used in the state statute, providing that no ordinance granting a franchise should be passed by the council on the day of its introduction nor within five days thereafter, and requiring a vote of at least four councilmen. The fact that the right was denominated a franchise in the ordinance and in the grantee's bond did not make it a franchise. Wallis v. Fidelity & Deposit Co. of Maryland, Washington Supreme Court, 285 Pac. 656.

Proof of Defective Construction or Negligent Management of Sewer

In an action against a village for damages due to the backing up of sewage upon private property, the Ohio Supreme Court holds, Village of Willoughby v. Malone, 122 Ohio St. 315, 171 N. E. 402, that it is reversible error to charge the jury that, "If you find that plaintiff's house was properly connected with the sanitary sewer, evidence of failure of the sewer to drain plaintiff's property is prima facie evidence of defective construction or negligent maintenance." The fact of the failure of the sewer to drain the plaintiff's property was held to be equally consistent with the presumption that it arose not from defective construction, or from negligent maintenance, but from one of several other separate and distinct causes, namely, from inadequate size of the sewer, arising from original plan, or from inadequate, although not defective, construction of the sewer, arising from error in judgment in carrying out the plan, for which causes it is generally held the corporation would not be liable.

Sewer Construction—Additional Compensation for Delayed Performance

It is broadly true that, where a city council has entered into a contract which is within its power to make, and such contract is fully performed, to the benefit of the city, and its validity fails for lack of formality or procedure in the adoption thereof, the city will be estopped, while retaining the benefits, to plead *ultra vires*. This doctrine is never applied, however, to the validation of any contract where the city council purports to do what it has no power to do by any procedure. Nor can such rule in the very nature of it be applied to a case where no *public* benefit was received. The relinquishment by a sewer construction contractor of part of his claim for additional compensation for delayed performance caused by the interruption of the work to do government war work was not a public benefit which would sustain the remainder of the claim. A city which has paid the full contract price for the construction of sewers has no legal power to add to the compensation paid, nor to compromise a claim for additional compensation. No power exists in a city council to appropriate public moneys to private use without public benefit, and no such power can be conferred upon it by legislative act. Love v. City of Des Moines, Iowa Supreme Court, 230 N. W. 373.

Liability for Injuries in Sewer Construction

Under Maine Rev. St. 1916, C.22, §2, (1930, c. 25, §2) the authority to construct public drains or sewers along or across any public way is vested, not in the city or town of their location, but in the municipal officers. Authority for such construction is by vote of the town and an appropriation made for the purpose. Municipal officers constructing a sewer pursuant to such statutory authority act, not as agents of the city or town, but as public officers, for whose torts the municipality is not liable. And a town which has assumed no responsibility as to the construction of a sewer in which a workman is injured by a cave-in beyond authorizing the construction and appropriating money therefor is not liable to such workman for his injuries. Arsenault v. Inhabitants of Town of Anson (Me.) 152 Atl. 627.

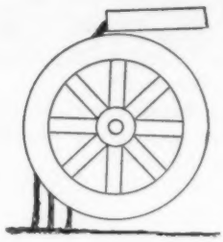
Liability for Injury by Blasting Caused by Independent Contractor on City Contract

A construction company which had contracted with a city to do excavation work for a stadium at unit prices made an agreement with another contractor under which the latter was employed to do the work at a contract price. Heavy blasting became necessary and a house was injured thereby. The owner sued the city and the contractor. It was held, Johnson v. City of Asheville, 196 N. C. 550, 146 S. E. 229, that while the contractor which did the work was an independent contractor, who was primarily liable for the damage, and that the city and its contractor were secondarily liable, to the plaintiff, the city was entitled to have tendered the issue whether, as between it and the construction company, the latter was primarily liable and the city secondarily liable, since, where one does the act which produces the injury, and the other does not join in the act, but is thereby exposed to liability and suffers damage, the latter may recover against the principal delinquent.

Finding as to Noncompliance with Sewer Construction Ordinance Must Be Specific

If a county court, in a proceeding under the Illinois Local Improvement Act, finds that the work on a sewer was not done in substantial compliance with the ordinance, the finding must be sufficiently specific to inform the board of local improvements and the contractor as to what shall be done to complete the improvement according to the ordinance. The sewer in this case was 34 miles long and cost about $500,000. The finding of the court was merely that it was not completed in substantial compliance with the ordinance. This the Illinois Supreme Court, Blackhawk Const. Co. v. Village of Homewood, 175 N. E. 427, holds was not sufficiently specific and not in accordance with section 84 of the act.

THE WATER WHEEL



By
Jack J. Hinman, Jr.

The essental features of important articles of the month having to do with water works design, construction and operation and water purification, arranged in easy reference form and condensed and interpreted by a leader in the water works field. Published every month to include articles appearing during the preceding month.

Design and Plant Construction

IN locating work for the **unemployed** portion of the population during the current depression period many people have advocated the creation of jobs by embarking on a program of extensive public improvements. Work on projects of a minor nature or on plant betterment may be more generally feasible. **Laying of mains** and **grading** and **landscaping** of the grounds of water plants[120] have been favorite means of creating immediate relief, for few water plants have been able to keep fully up to their needs along these lines and therefore welcome the opportunity to make the desirable innovations. To those who have had **financial difficulties** in securing water works extensions, the story of the work of **Sir Hugh Myddelton** on the New River water for London[22] will be interesting. The final appreciation accorded Myddelton by the King should be comforting to superintendents who feel that their work is unappreciated by the public they try to serve.

Cities continue to exhume their most **antiquated pipe lines** and to view the disinterred mains with surprise and wonder. This time it is Chicago[n7] that has been delving into the past. But Chicago's mains, laid in 1861, are not so hoary with age and tubercles as some other examples of the faithful cast iron pipe. A valuable study of **failures of water mains** under British conditions prepared by a committee of the Institution of Water Engineers is made available to American readers through the medium of the Journal of the American Water Works Association[49]. Some pipe lines may be expected to need **cleaning** more frequently than others if the carrying capacity is to be kept near the original value. Specially prepared **pipe pits** adapted to the cleaning technique which has been developed are claimed by Clark[6] to reduce the cost of doing the work of removal of accumulations in the pipes. **Pitometer surveys, meters** and **meter testing**[n109] all have their parts to play in keeping the distribution system capable of delivering the water to the consumer with the minimum of loss.

Articles of Special Interest:

Lead joints and **joint compounds,** Nuebling[117].

Freezing mixture helps in making connection without interrupting service, Burkhart[n2].

Discussion of Schorer's suggestions for **large pipe line design**[66].

Designing the **piping** for the Western Avenue Pumping Station, Chicago, Carlisle and Kennedy[5].

Engineers inspect **San Joaquin pipe line** 56″ to 66″; steel with wrapping of cement mortar and cloth, Shaughnessy[121].

Kind and Size of Pipe for **Services**[111].

"Pumreg" **automatic governor** to prevent overloading driving unit in case of sudden drop of pumping head[n101].

Friction heads in **1″ C. I. tees,** Giesecke and Badgett[41].

Cell concrete as pipe insulator[12].

Gardner S. Williams, famed hydraulic engineer, died December 12, 1931[n123].

Current **American Practice** in gate valves, pipe jointing and friction studies reviewed, Carey[95].

Hathorn-Davey installations of **reciprocating pumps**[96].

Gas-fired water works boilers at San Antonio, Nealey[116].

Useful discussion of operation and maintenance of **centrifugal pumps,** Phillips[62].

Somewhat more than the usual amount of discussion of **earth-filled dams** is evident in the current periodicals. Moore and Williams[29] continue the symposium on the composition of these dams. The dam of the Irvine Ranch Company retaining 1,090 acre feet of irrigation water in Peters Canyon, Orange County, California, is of the earth fill type[42]. In stopping **leaks in earthen dams,** stop the turbidity of the outflowing water first of all, is the advice of Neylon[10]. A suitable filter set into the dam will clog and stop the passage of the turbid water carrying away the stuff of which the dam is made. A leaky earth enbankment at Macclesfield, in Great Britain[73,77], was found to be due to the **outlet pipe having failed in tension.** When the embankment was built for the Bottoms Reservoir at Macclesfield, about 1850, two 12″ cast iron pipes were apparently laid on timbers in the bed of the existing stream and the bank erected over the pipe. Sagging of the embankment put the pipe in tension. Overflow of the earth dam of one of the reservoirs at Redruth[99] caused leakage, apparently because the puddle core in the upper portion of the dam had dried out. It was stopped by introducing clay slurry deeply into the dam on the upstream face. The Bartley Reservoir[100], of Birmingham, England, began to leak as a result of water getting into a seam of sand or soft sandstone. **Grouting** had been used in the effort to stop such an occurrence at the time the dam was built, but apparently the grouting was not sufficient. Bryn[70] describes a method of reconditioning masonry dams with thin vertical slabs of reinforced concrete held a short distance away from the upstream face of the dam by short horizontal members, also of concrete. Sufficient elasticity of the assembly is claimed to permit the slab to contract and expand freely in its own plane, thus avoiding formation of fissures.

Articles of Special Interest:

First six month progress at **Hoover Dam**[30].

Building and testing an **arch dam model,** Karpov and Templin[19].

Hoof dam design, A. M. A. Struben[93].

New Westcott **Distributing Reservoir** at Syracuse, N. Y., Stewart[52].

New Basins for Howard Bend Plant at St. Louis[n38].

Reservoirs safety provisions act of 1930 in Great Britain, Griffith[71].

$220,000,000 project for **Southern California** (Colorado River Aqueduct)[27].

Colorado River Aqueduct bonds held valid[n32].

San Diego to build El Capitan Dam for water supply[n35].

Newark, N. J., uses small **suction dredge** for reservoir cleaning[136].

Following the **lining** of the diversion tunnel and the pressure tunnels to supply Springfield, Massachusetts, with water from the **Cobble Mountain Reservoir**[33], some 315 cubic yards of grout were used to fill the openings back of the lining and in the rock[36]. The diversion tunnel is 1,600 feet long and the pressure tunnel is 7,100 feet in length. Careful measurements of the tunnel were made under the direction of Harry H. Hatch, the engineer in charge, and the amount of grout required agreed surprisingly closely with that calculated from the measurements. At **Sydney, New South Wales, a** tunnel 10 miles long was driven through Hawkesbury sandstone. An 18 inch concrete lining was placed and the space back of the lining was filled with grout forced in in two stages at 90 and 300 pounds pressure. Cavities still existed. Tests showed rupturing, according to Haskins[75] and consequently a steel pipe was carried through the tunnel and the space between the pipe and the tunnel wall filled. New York is building a tunnel from Hill View Reservoir in Yonkers to South Brooklyn, a distance of 20 miles[28]. This tunnel is 17 feet high and is many feet below the ground surface.

A tentative draft of **Specifications for Steel Standpipes and Elevated Tanks** has been prepared by Committee No. 7H of the American Water Works Association[56]. The specifications of the New England Water Works Association for the **painting of standpipes** are incorporated in the general report. Architectural disguise in the form of masonry towers surrounding elevated steel tanks has been used at Ossining[n1], and Scarsdale,[34] New York. In each case the cost of the **masonry shell** exceeded that of the tank by a considerable amount.

Articles of Special Interest:

Cumberland, Maryland, gets its water from reservoirs across the state line near Bedford, Pennsylvania[n126].

Text on **reinforced concrete** reservoirs and tanks, Gray[31].

Hearing on **Bunvale Reservoir** in Hunterton and Morris Counties, New Jersey, postponed from December 9th to 23rd[n124].

East Chicago, Indiana, improves its water by installing two mile intake, Miller[129].

Plant Descriptions and Plant Extensions

Boulder City, Nevada[127]; Cedartown, Georgia[n4]; Edson, Alberta[n16]; Vancouver, British Columbia[n17]; St. Catherines, Ontario[n18]; Bermuda[n122]; Santiago de Cuba, Pierce[105]; Santiago and Valparaiso, Chile, Hartley[103]; London England[n91]; Devizes, England[94]; Paris, France[89]; Capetown, South Africa, Lloyd-Davies[72]; Durban, South Africa, Campbell[26]; Jerusalem[n138]; Shanghai, China, H. Stringer[24, 25].

Well Supplies

The **water diviner** has mysterious attraction for many water supply men. Consequently a treatise on the subject by Henri Mager, translated by Bell[23] will have an interest to a portion of the men of the industry. The tremendous springs of **Florida** and the associated ground waters are discussed by Thompson[50]. Bowman's more general discussion of the water bearing formations of the United States is appearing in reprinted form[43]. The use of compressed air and the air lift in **developing wells** is a valuable addition to the well driller's technique, but in the opinion of Williams[46] it does not entirely supersede the surge block and plunger in development work. **Bronze-welding of** well casings[132] as they are being placed in the well is recommended.

Articles of Special Interest:

The **engineer's part** in developing a well supply, White[47].

Hydraulics of wells, Williams[48].

Water Treatment

Baylis continues his scholarly study of the use of charcoal and **activated carbon** in water purification[108]. Fitzgerald[14] and Dugger[113] have both found activated carbon helpful in reducing odors and tastes in Virginia water supplies. Smit[39] discusses experience with activated carbon at length in French, though much of the work described is Dutch.

Upland surface waters in the Pacific Northwest may show very high **colors,** though this is not always the case. Bovard and Shibley[55] in their studies of chlorine removal have followed the suggestion of Miller that much of the color is in the form of negatively charged colloids and find that a low pH (between 5 and 6) is most useful in reducing the amount of color remaining after treatment with aluminum compounds. Tyler's results are similar[53]. Hansen[61] gives an excellent elementary review of water purification history in the **Middle West.** Williams[11] treats of the **operation problems** which puzzle filter operators under Missouri conditions. **Municipal water softening** continues to spread in the hard water areas, but highly variable results are obtained in the different installations[133].

Articles of Special Interest:

Softening at **Boca Raton, Florida,** McCurdy[3].

English industrial **water softening** installation at Newton-le-Willows[n102].

Treatment at **Knocke-sur-Mer,** Belgium, Cauterman[85].

Purification of water in the **French colonies,** Casteels[88].

Treatment of water at **Cali, Colombia,** Bunker[n115].

Treating turbid **Missouri River** water at Leavenworth, Kansas, Linck[119].

Feedwater treatment shows advancement[65].

Alkaline waters in boiler use, Baker[64].

Compressed air used to blow water out of horizontal blowdown pipe and into sewer, thus avoiding freezing and plugging of pipe with ice[63].

Financial and Legal

The status of **interstate waters** in their application to municipal water supply has attracted great attention on account of the disputes between the States of New York, Pennsylvania and New Jersey over the water of the Delaware river and the dispute of the States of Massachusetts and Connecticut over the Ware and Swift rivers, tributaries of the Connecticut river. Merriman[57] has extensively discussed the first of these

(Continued on page 50)

To this urgent message

Reprinted from the December 1931 issue of the Journal of the American Water Works Association, we are glad to devote our regular space in the publication you are reading, and others, in order to give it additional circulation.

UNEMPLOYMENT

Work is Scarce in Many Lines of Endeavor

—— o ——

For instance out of the 10,000 engineers in the metropolitan area around New York City 2200 *are now out of work* and the situation is even more serious in some other places.

—— o ——

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THE Committee on Economic Conditions of Water Works Personnel of the American Water Works Association urges you to give this matter your earnest thought and to cooperate to the fullest extent possible.

William W. Brush,
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Jersey City's Boonton Sewage Treatment Plant

IN our January issue Mr. Mallalieu described how the appearance of the grounds of the sewage treatment plant maintained at Boonton, N. J., by Jersey City was improved by grading and planting of trees, shrubbery and flowers. There are a number of interesting features of this plant itself, aside from its surroundings, which Mr. Mallalieu described in a paper before the New Jersey Sewage Works Ass'n, an abstract of which is given below.

Jersey City, N. J., draws its water supply from a large reservoir at Boonton, N. J. On the watershed of this reservoir are five towns, and the city has built a plant to give the sewage unusually thorough treatment, to prevent it from polluting the water supply.

This plant consists of screens, sedimentation tanks, separate sludge digestion tanks, glass covered drying beds, contact beds, slow sand filters, and sterilization.

At the end of the 39-inch trunk sewer which brings the sewage to the plant are two coarse bar racks with 2-inch clear openings. Immediately behind these are weir wells and two V-notch weirs, which, with a Yarnall Waring recording and integrating gauge, give a continuous flow record. Twin 12-inch inverted syphons 2077 feet long carry the sewage to the sedimentation tanks.

Sedimentation Tanks. There are twelve sedimentation tanks, capacity about 1,000,000 gallons, 100 feet long, 6 feet deep at the outlet end and 13 feet at the inlet end, roofed over. Each contains two roof baffles, one 25 feet from the inlet end, the other 2 feet from the outlet weir. The weirs are adjustable in height, and are set slightly higher than the under side of the roof. Mr. Mallalieu reported that a one-inch head against the roof was effective in preventing formation of scum. During 1930 these tanks removed an average of 79% of the total suspended solids, reaching 86% at times. After each run, which varies from 4 to 21 days, a tank is entirely emptied and flushed, the flat slope of the bottom preventing satisfactory operation on the fill and draw principle; the supernatant liquor being drawn down by a syphon through the outlet weir whenever the tanks are removed from service.

The sedimentation tank effluent flows by gravity to five hopper-bottom digestion tanks, all of which are connected to a sixth or regular tank containing a floating outlet pipe through which the displaced liquor discharges into the influent of the contact beds. The sludge enters these tanks through four drop manholes on top of each tank, allowing for even distribution, and all manholes are carried down below the surface of the liquid to prevent the escape of gas.

These tanks have a slight V roof and cylindrical gas collectors from which the gas is piped to a larger gas holder adjacent to the drying beds.

The hoppers of the five tanks have a capacity of 16,000 cubic feet, with 66,000 cubic feet capacity above the hoppers.

These tanks are earthed over with terraced sides, and have a temperature range from 45 to 64 degrees throughout the year. At present they are unheated, but this will probably be changed this year.

No records of the digestion periods are available, but normally all five tanks are drawn during the warmer months of each year.

Sludge Drying Beds. There are four of these, under typical greenhouse superstructure, covering an area of 11,046 feet or approximately one square foot per capita at present loading. They are ventilated by one side vent opening outward and double ridge vents. For experimental purposes six panes 24 by 16 inches have been framed and hinged to open inward on one bed and have proven helpful.

Four 9-inch gas burners are fed from the digestion tanks, but even when all four are burning, the effect on the temperature is negligible. They do, however, aid in ventilation as they are set fairly close to a 7-foot concrete wall along the southerly side.

The dosage on these beds has been gradually reduced; 9 inches is now considered a maximum for best results. It has been found that a reasonably high percentage of water is desirable in the sludge; just where the optimum lies has not yet been fully determined. Also, experiments have shown the practical uselessness of the underdrains, the sand voids having sufficient capacity to hold the liquid leaching through.

Temperatures are taken daily. Monthly averages of these for 1930 show the temperature inside the beds always higher than outside, the differences varying from a minimum of 9° in November (52° and 43°) to a maximum of 21° in May and June (92° and 71° in June).

Aerator Manholes. The effluent of the sedimentation tanks may pass through an ingenious arrangement of five aerator manholes, which consist of adjustable goose-neck pipes over a needle valve at the crest of twin 6 and 10-inch syphons through which air is drawn to supply the oxygen demand, eliminating the nuisance often present when the same result is attained by cascading. Because of a sufficiency of dissolved oxygen, however, the usual procedure is to by-pass under these syphons; but actual working tests have shown their practicability, with a resultant increase of 8.3 per cent in D.O. content.

Contact Beds. These total two acres in extent; made up of two duplicate sets of four units each, 6 feet deep, with the influent entering the bed 2.4 feet below the surface through a radial feed line, from which, at 14-foot intervals, 10-inch pipes with open joints and parallel with the side lines distribute the sewage through the stones, which range between ¾ and 2-inch limits.

These beds have been operated as contact beds and trickling filters, but so far the results obtained have been somewhat below expectations. The effluent averages over the year one p. p. m. suspended solids in excess of the settling tank effluent. Undoubtedly some solids are added to this effluent by the settling tank syphons and the displaced liquor from the digestion tanks; tests are being made to determine the extent of this addition.

There is an average increase of 4.4 per cent in D.O. content, and a reduction in nitrites from about 0.09 to 0.06, and also a slight reduction in nitrates; insufficient analyses are now available to make these figures conclusive.

Sand Filters. These total six acres, divided into sixteen units, fed by distributing wells at the contact bed outlets, which enable any bed to discharge on any filter. The sand is 30 inches deep, with under-drains in 12 inches of gravel. The specifications for the sand

call for a uniformity co-efficient of not greater than 4, with an effective size between 0.4 and 0.6 mm. limits. These filters have been operated semi-continuously and intermittently without effecting any appreciable difference in the character of the effluent. At no time in the twenty-seven months of operation has there been a measurable amount of suspended solids, and on only three occasions a noticeable amount of turbidity, twice on extremely cold Mondays, and once when experiments were being made on the filters a slight cloudiness appeared, but to such a small extent as not to be noticeable except in large volumes.

The filter effluent during the year 1930 showed a reduction in bacterial content over the raw sewage of 97.72 per cent, and 99.99 + after chlorination. Nitrates in the filter effluent showed an average increase during 1930 of 1.2 p. p. m.

Relative stability tests of the filter effluent were taken for the first five days of each month; of all taken during the year, one lost color in six weeks, but no other changed color in three months' incubation.

Sterilization. The sand filter effluent is sterilized by means of a W & T solution feed chlorinator, two detention tanks with two bays each providing for a contact period of one hour under maximum anticipated loading. An average of 2.04 parts of chlorine per million is used.

Summary. The plant influent showed a fairly weak average of suspended solids for 1930, but was constantly increasing in strength and for the latter months of the year gave approximately 200 parts per million suspended solids; while nearly twelve hours old, it is still fresh but with finely divided solids.

After progress through the plant, the filter effluent is clear, sparkling, with a 100 per cent reduction in suspended solids, a dissolved oxygen content of 51 per cent of saturation, and a reduction in bacterial content of nearly 98 per cent.

After chlorination, the bacterial reduction for 1930 equalled 99.999+ per cent and at no time during the twenty-seven months of the plant's operation has there been B. Coli in 10 cubic centimeter samples.

The average 37 degree bacterial count of the final effluent was 32, with a chlorine residual of approximately 0.5 p. p. m. Control tests are run on the filter effluent to avoid the possibility of a false residual.

The nuisance is negligible; there is no odor except when sludge is drawn, and then it is only slight.

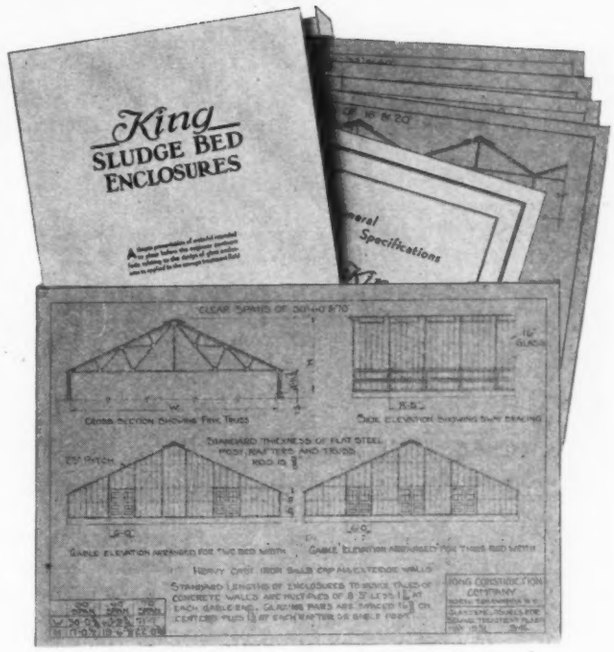
The plant cost approximately one million dollars, or fifty dollars per capita of rated capacity. It is operated by a chemist and about six laborers.

City Pays Cost of Treatment Plant in Damages

Rome, N. Y., recently put into operation a new sewage treatment plant and intercepting sewers which convey all of the city's sewage to it. The cost of the plant was slightly over $221,000.

An interesting fact in this connection is that the city has paid about $200,000 in damages collected by riparian owners along the creek into which the sewage was discharged, because of such discharge, annual payments of about $14,000 a year having been made for a number of years. The effluent of the new plant not only is less polluting, but it is discharged into the Mohawk river, which affords much more dilution.

The plant provides sedimentation, separate sludge digestion, and chlorination of the effluent.



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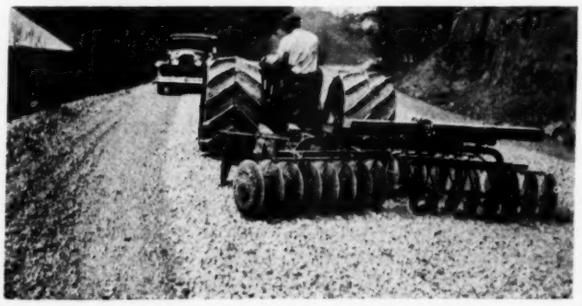

Preserving Trees Along California Highways

Most commendable effort is made by the California Department of Public Works to preserve as far as possible all trees of a desirable character and condition found along roads which are being improved. Before grading and paving 14 miles of Cherokee Lane, part of the Golden State highway north of Stockton, a detailed field study of line and grade adjustments was made so as to preserve as many as possible of the trees which line the greater part of its length, some of which were planted many years ago for shade purposes, while others were natural oaks and some were orchard trees planted by abutting property owners.

The road cross-section is the so-called "turnpike" section, which makes use of practically the full width of the 100-foot right of way by placing shallow draining ditches a foot inside the right of way and carrying a flat slope from the shoulder edge to the bottom of the ditch.

Practically all the trees which came between the shoulder line, which is eight feet from the edge of the pavement, and the ditch were preserved, except some of the orchard trees which were in many cases planted so closely together that it was impracticable to work around them, and these were thinned out, making room for grading equipment and still not impairing the general effect.

Adjoining the east city limits of Lodi, a 76-foot width of pavement was built as a cooperative project in which city, county and State participated, and here all the widening was done on the easterly side of Cherokee Lane to avoid disturbing the more highly developed property on the west. This made necessary the removal of most of the trees on the east side of the road. Also, north of Lodi, there was planted under permit from the State in 1921 a row of oriental plane trees on each side of the road for about one mile to the Mokelumne River. These were so close to the road that it was decided to adjust the center line of pavement to leave one row intact, the westerly row being eliminated.

In these two places it is planned to replace the trees removed by new trees to be planted by the State this fall in the proper position.

A number of the residences along Cherokee Lane have nicely landscaped front yards with shrubs and lawn. All of these were left practically in their original condition by carrying the side drainage through a metal culvert under the yard.

Moving a River to Straighten a Road

U. S. Highway No. 12 passes through the heart of the business section of Kalamazoo and through the suburban village of Comstock about two miles away. Within this distance it crosses the Michigan Central Railroad tracks at three places, and the tracks of two other railroads at other points. A new location has been chosen and is now under construction which eliminates the crossings of the Michigan Central and the use of heavy-traffic streets in the city, but crosses the crooked channel of the Kalamazoo river at seven points. Six of these crossings are being eliminated by straightening three loops of the river, giving a practically straight channel parallel to the road until, just before reaching the city limits of Kalamazoo, the river swings permanently away from the new route, first crossing it and making a bridge at this point necessary.

Straightening the channel required a total of 1,800 feet of cut 120 feet wide through solid earth. Alex. Jeffrey of Saginaw had the contract for the 225,000 cu. yd. of excavation involved, at a cost of $137,000. Two gasoline shovels and 20 trucks were used, additional earth for fill for the road embankment being obtained from ten acres of nearby waste land.

The highway embankment is 56 feet wide on top. Six culverts at the crossings of the old channel were required, and a bridge consisting of three 65-foot spans, built by the Wickes Engineering & Construction Co. of Des Moines.

The resident construction engineer for the state highway department was R. A. Beers; A. O. Krogh and R. I. Van Orden were project engineers on the grading and drainage structures, and V. B. McCracken on the bridge.

The George S. Bartlett Award

An award with this name has been created jointly by members of the American Association of State Highway Officials, the American Road Builders' Association and the Highway Research Board for the twofold purpose of honoring Mr. Bartlett, "whose vision, energy and personality have made him a prime factor in the spread of modern highways," and of honoring each year "some individual whose interest in highways has been of national benefit."

The first award was made this year to Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads for the last twelve years, the presentation being made at the opening session of the annual meeting of

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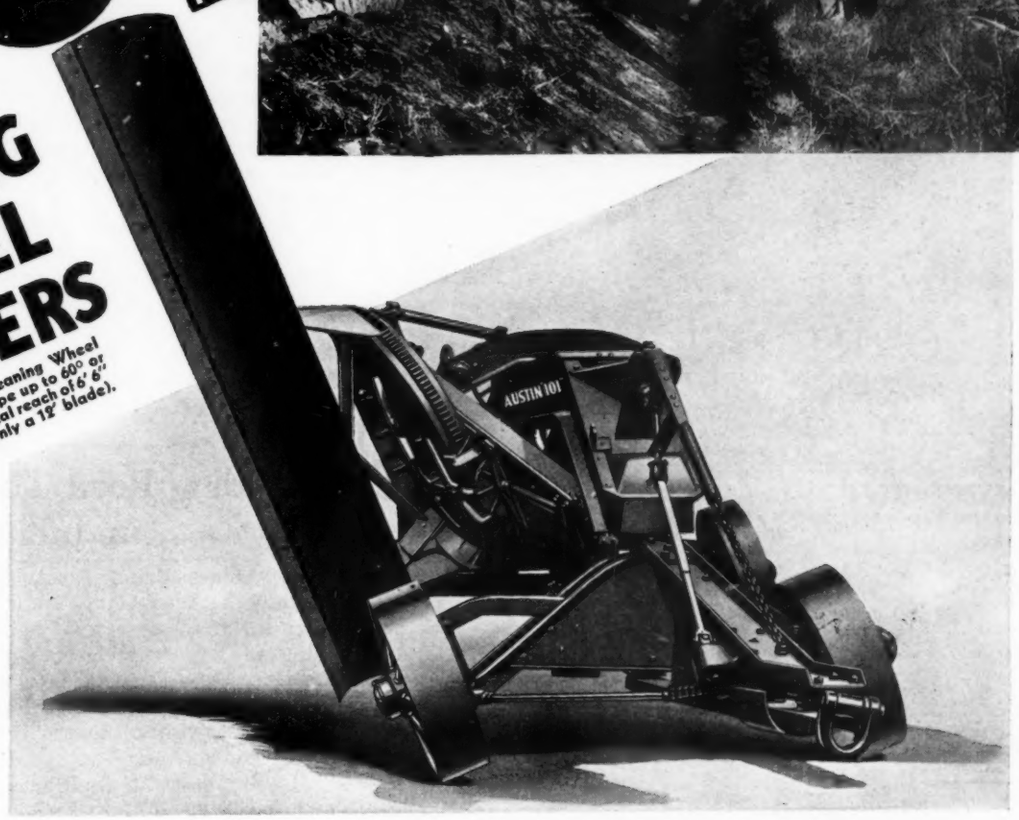

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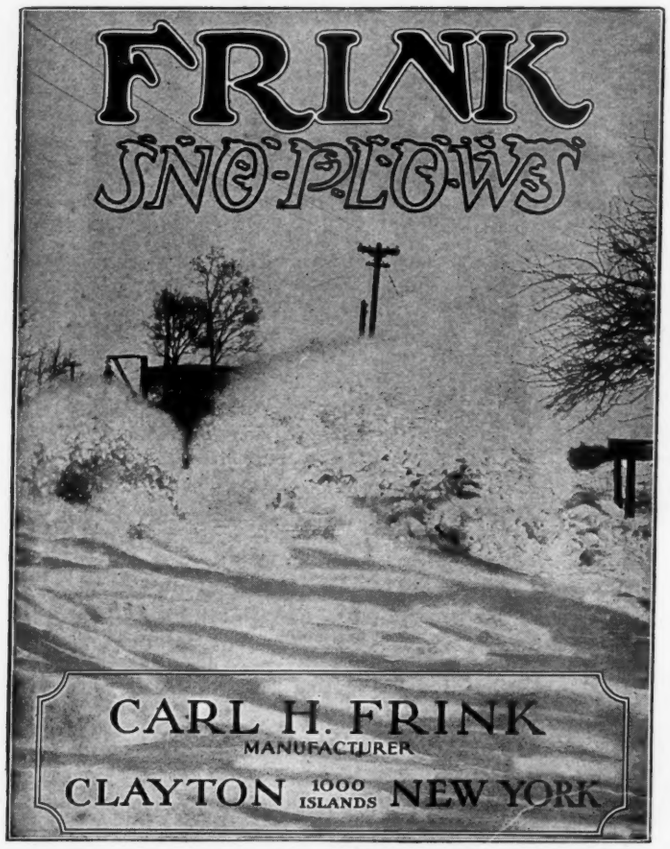

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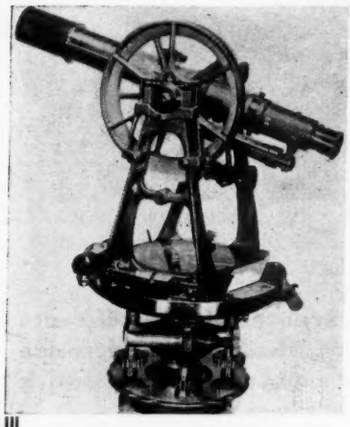

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the American Road Builders' Association. The award consists of a bronze wall plaque which bears a portrait head of Mr. Bartlett and the inscription: "For outstanding contribution to highway progress."

Mr. Bartlett has been identified with the portland cement industry for 43 years and is a member of the staff of the Portland Cement Association.

A. S. M. E. Research on Oil Engine Power Cost

A committee of the Am. Soc. of Mechanical Engineers has for three years been collecting cost data from operators of oil engine plants that generate electric power, covering several years of operation. The 1929 report covered 27 diesel plants containing 68 engines; the 1931 report lists 94 plants containing 283 engines.

The investigations of the committee have not only obtained costs of the several features entering into power plan operation, such as data on fuel and lubrication economy, lubricating oil purification, cooling water handling, liner wear, peak loads handled, etc.; but also has resulted in educating operators of plants to collect such data at their own plants and apply them to increasing the efficiency of same.

The committee is now sending questionnaires on 1931 operation to all operators on its list. Any who have not received one by February 15th are requested to write to the secretary of the committee, M. J. Reed, Room 1710, 30 Church St., New York City.

Building Road Through Muck in Indiana

The Dunes Relief Road, thirty miles of 40-foot highway between Gary, Indiana, and the Michigan state line, crosses several miles of swamps with a sub-grade of vegetable ooze or muck. Two of these are in sections D and E, for which the M. D. Heiny Co. of Gary received the contract. Work on these was begun last winter because the ground is softer in spring and summer.

It was required that all muck under the road bed be removed down to firm ground and replaced with sand and gravel, which was brought from nearby cuts through which the road was graded. The first muck bed was 1900 feet long and reached a maximum depth of 17 feet. The method of operation was as follows: Two Northwest cranes using 1¼-yard clamshell buckets worked side by side and excavated the muck in front of them for the full width of the road, depositing it just outside the limits of the road fill. Meantime twenty-seven 1½-yard dump cars, operated in three trains on an industrial track, brought sand and gravel from where a road cut was being made and dumped it just behind the cranes. As soon as the cranes had removed the muck within the 29-foot radius at which they operated, they swung around and picked up the sand and gravel and deposited it in the hole and to a height of four or five feet above swamp level; then moved ahead onto the new grade and repeated the operation.

In this manner they removed 800 cu. yds. of muck a day. In the first 16 days of the work, when the haul was comparatively short, 10,000 cu. yds. of muck were removed and 16,000 cu. yds. of material were dumped into the excavation. The maximum haul was 3000 ft.

The second muck bed was somewhat longer but not nearly as deep, and was handled in the same manner.

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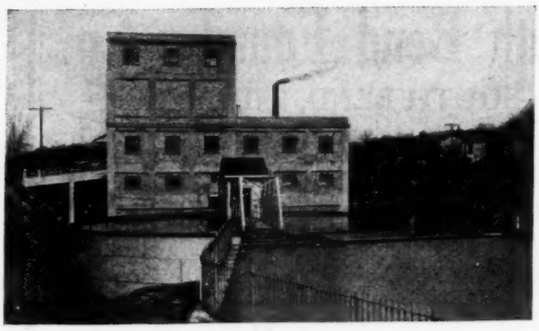

Cleaning Catch Basins in Chicago

The bureau of sewers of Chicago cleaned 73,510 catch basins in 1930. There were 176,253 basins in the city, so about 60% of them were not cleaned at all; and if any were cleaned more than once, this percentage was greater. (As we have stated before, we believe that a basin which is not cleaned at least two or three times a year is worse than useless.)

Of these cleanings, 30,720 were by machine and 42,790 by hand. Machine cleanings cost $2.58 each, hand cleanings cost $3.77 each. Of the $79,310 cost of machine cleaning, $60,044 was for wages, $2,640 for repairs, $4,154 for supplies, and $12,472 for interest at 4%, and depreciation at 30 cents a mile for the 32,624 miles travelled.

Bermuda Has Unusual Water Supply System

For the first time in its history, the island of Bermuda has a public supply of potable water, which was put into operation on November 30. Professor W. D. Turner, of the department of chemical engineering at Columbia University, planned and directed the construction.

For generations, sea water has been used by the island residents for general purposes, while rain water caught on the housetops (and frequently polluted to a high degree) has been the source of the drinking supply. In addition, water from New York City has been purchased and used extensively to augment the rain water supply for the larger hotels.

The new system consists of a trench about 250 feet long and 4 feet deep dug at the base of a hill near Hamilton. Fresh water filters through rock crevices into a pipe line laid in the trench with open joints, and thence to a concrete basin or pump-pit dug below sea level. From the collecting basin the water will be pumped into a new reservoir at Pymwood near Hamilton. The system will include a water-softening plant which will also remove soil bacteria.

The capacity of the island system is 300,000 gallons. In the United States, this supply would meet the demands of a community of 3,000 persons. The population of Hamilton is 6,000 but owing to the conservative use of water in Bermuda the new system will more than meet the demand. It is estimated that the trench will collect about 50 per cent of the rainfall, which is 60 inches annually, approximately the same as that of New York and New Jersey.

Baltimore Water Department Accomplishments

Manufacturing Filter Alum

All the alum used for the treatment of the water was manufactured at the new plant. A careful estimate, including hauling and fixed cost on the equipment necessary for its manufacture, showed the total cost per ton of 2,000 pounds of alum to be $10.61, which is only a little over half the price paid for alum under our last contract which was made in March, 1927. In estimating the cost, no allowance was made for overhead, as there is no additional overhead cost. No allowance was made for labor, as the cost of making alum involves considerably less trouble and labor than was previously required for taking the alum from the bins and mixing it into solution. The manufacture of alum is a simple process of uniting bauxite, which is a clay rich in aluminum, sulphuric acid and water, under conditions suitable for the necessary chemical reaction. The alum as made in the new plant is in liquid form and a portion of it is piped over to the old plant for use there. This piping of alum has resulted in a considerable saving of labor as it does away with the necessity of mixing alum. The saving thus effected was not taken into consideration in estimating the cost of alum.

Copper Sulphate at Loch Raven

Copper sulphated was applied at intervals of about one week apart to Loch Raven Reservoir beginning in April and continued until August. The effect of the copper sulphate was to reduce greatly the number of organisms in the water. This was particularly noticeable during the height of the drought season, as the water was unusually clear and free from organic growths. The killing of so many organisms released essential oils, which caused a taste in the water early in the season, which might not have existed if the stream had been flowing over the crest of the dam as usual. In making the application of copper sulphate, no effort was made to cover the entire body of water, but an amount sufficient to treat each of the larger coves with 1/10 part per million was applied each week. The treated water in the coves was gradually displaced and forced out into the main reservoir. There was no evidence of any injury to fish life except in one instance, when an overdose was applied to a very shallow cove.

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to learn the comprehensive knowledge that some of the pupils in the grade schools have of the water works of Baltimore. The visits of the school children offer a wonderful opportunity of impressing upon the future voters the value to the city of an adequate supply of pure water, and a favorable impression made on the children and youth of today is sure to result in favorable reaction when water works problems of the future come before the citizens.

Main Laid in Acid Soil

In Holabird Avenue, 6,952 feet of 36-inch cast-iron main was laid, at a point where the old Baltimore Copper Works used to waste its copper sulphate residue. Samples of the soil in this street were taken by means of test holes dug approximately 50 feet apart and were found to contain a maximum of 1% free sulphuric acid. As this would be very injurious to the iron pipe, steps were taken to protect the pipe against this acid soil.

The first method of protection was to encase the pipe in an asphalt of minimum thickness of 4 inches. A wooden form was set a minimum distance of 4 inches from the side of the pipe, and the bottom and sides of same filled with asphalt poured into this form, encasing the pipe. The asphalt was first heated to a temperature of 430 degrees, which was found to be too high and was reduced to 340 degrees, and later it was found necessary to reduce the temperature to 180 degrees because at the temperatures of 430 and 340 degrees the asphalt flowed too freely and could not be confined in the forms. The total distance treated in this manner was 288 feet, the cost running up to approximately $36 per foot. After consulting chemists and the Bureau of Standards, the asphalt covering was abandoned, and the following was adopted.

For a distance of 2,612 feet a concrete floor 4 inches thick was laid on the bottom of the trench with a 6-inch underdrain. The pipe was then placed in the trench and painted with an asphalt paint which contained 1% oleic acid. Two coats of this paint was applied to the outside surface of the pipe and then a burlap dipped in the asphalt paint of 1% oleic acid by volume spiralled around the pipe. In addition to this, the pipe was encased in concrete to a minimum thickness of 4 inches.

The concrete consisted of a 1-2-4 mix, to which was added 25% hydrated lime by volume. In order to arrive at the unit cost per foot for the protection of the pipe in the above manner the contractors were instructed to lay a 500-foot experimental section on a time and material basis, being allowed 10% of, the cost of labor, rental, machine power, tools and equipment to cover overhead, and 10% of this resulting amount allowed for profit. This 500-foot section was done under the constant supervision of an engineer appointed by the Public Improvement Commission and the total cost of same amounted to $12,818.22, making a unit cost of $25.60 per foot. The total distance of pipe protected on Holabird Avenue was 2,125 feet. This is the first occasion, in Baltimore, where a main of this size was protected against an acid condition of the soil.

Temporary Main Across Low Land

At one point in a mile of 24-inch main, the line crossed a low point where a deep fill is to be made at a later date, giving a very deep cover to pipe. Here a 16-inch steel pipe was installed temporarily until the above fill is made, when this temporary steel line will be abandoned and the 24-inch cast-iron main laid across the fill.

Operating Costs of Sewage Treatment in North Carolina

Gastonia, N. C., treats slightly more than a million gallons of sewage a day in an activated sludge plant, using 2.03 cu. ft. of air per gallon at a cost, for plant operating expense, of $54.33 per million gallons; equivalent to $41.86 per 1000 lb. of dry solids removed. Ferric chloride was used as a sludge conditioner at the rate of 7.5 lb. per 1000 gal. of sludge. Oliver vacuum filters are used for dewatering sludge. Textile plant wastes increase the oxygen demand of the sewers to as much as 500 parts per million.

High Point, N. C., treats slightly more than a million gallons a day of purely domestic sewage by activated sludge, using Oliver vacuum filters and ferric chloride, at a cost of $42.78 per million gallons (about half the capacity of the plant). Power averaged $850 a month. The oxygen demand averaged 153 p.p.m.

A sprinkling filter plant at High Point treats 2.5 million gallons a day of sewage of which 16% is wastes from hosiery and textile mills. The sludge is treated in digestion tanks. The operating costs last year averaged $14.30 per million gallons.

Two Charlotte, N. C., activated sludge plants (described in PUBLIC WORKS for July, 1928) treat over six million gallons a day, including wastes from dyeing and textile plants. In one plant the sludge is dewatered by Oliver filters, in the other it is treated in digestion tanks. The operating costs average less than $23 per million gallons.

Sewage Treatment at New York Institutions

New York State is doing its share toward solving the stream pollution problem by treating the sewage from state institutions. (See PUBLIC WORKS for March, May and August, 1930.) During the year 1931 treatment works were put into operation at the Rockland State Hospital and at the Wassaic State School. At the Dannemora hospital and prison and at the Rome State School, new sewage works are nearing completion, and at Hudson, Napanoch and Thiells the institutional treatment works are being reconstructed. Contracts have been let for disposal works at the state prisons at Comstock and Matteawan. The new plant at Comstock is of particular interest because it will have a rotating trickling filter under glass cover. Construction of treatment works for the Hudson River State Hospital at Poughkeepsie was begun in October.

Grease Removal From Los Angeles Sewage

Grease removal from sewage at Los Angeles (where removal of other suspended matters before discharge into the ocean is not desired) is effected by passing the unscreened sewage through a tank with a detention period of 2 to 3 minutes, after aerating it in the inlet channels by discharging into it small streams of screened sewage at high velocity. The air aids in flotation of the greases and oils and a thick scum is formed which is removed by a mechanical scraper. Fifty to 75 per cent of the free grease has been removed at a cost of 15 to 30 cents per million gallons, excluding capital cost.

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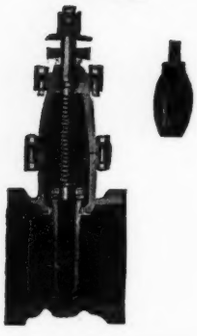

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The Water Wheel

(Continued from page 38)

controversies, and Winsor[58] has discussed the second Both papers provoked much comment[59].

An interesting story of experiences with **customer problems** is given by Miller[130] under the suggestive title of "Sugar Coating the Water Bill." Opportunity is being given distressed or unemployed consumers to **work out water bills** by a number of water departments and companies. The Pennsylvania Water Company of Wilkinsburg[n134], is using such help on location and marking of curb boxes. Seymour, Connecticut, citizens have appeared before the Public Utility Commission to **protest** against a proposed increase in water rates for their community[n125].

Articles of Special Interest:

The **"Water Dollar"** of Saint Louis, Missouri[n107].

Standby charges for water service, Thatcher[51].

Water works **obligations,** Parker[118].

Sacramento's Silver Creek Water Supply bond issue fails of 2/3 majority[n37].

Laboratory and Investigational

Manganese if present in water tends to clog zeolite softeners and even in the presence of organic material is usually completely removed. Adams[92] found much more effect exerted by organic substances on the removal of manganese from water subsequently treated with sodium carbonate, with lime or with potassium permanganate solutions. Hopkins[45] has found manganese to vary seasonally in the stored water which is used by Baltimore, Maryland. Apparently the carbon dioxide resulting from the fermentation of organic matter on the bottom and sides of the unstripped reservoir removes manganese from the soil. During the autumn overturn this manganese is distributed through the water and by aeration converted into an unstable hydrated oxide. Treatment with iron sulfate at a pH of 9.2 to 9.4 removes the manganese.

Investigations by Suckling[98] on the disinfecting action of **Catadyn silver** have shown that it has a germicidal effect. However, Suckling is of the opinion that the effect is not so great as believed by the inventor, Dr. Krause, of Munich. Krause's experiments were carried out using solid media for bacterial counts. Suckling insists that liquid media are more useful for the investigation of the germicidal property of the substance.

Two very instructive papers on the transmission of **water borne diseases** under tropical conditions have been given by Burtt[74, 78] and by Brau[86]. Worms, flukes and other diseases producing organisms are discussed as well as the usual typhoid fever and dysentery. **Western duck sickness** which has been attributed to the use by the ducks of alkali waters of the West is said by Kalmbach[69] to be almost certainly due to infection with **Clostridium botulinum,** Type C, of Bengtson. Isaacs[68] attempts to reconcile the theory of protein coagulation of Bancroft and Richter with the theory of enzyme destruction of Duclaux in explaining the **action of germicides.**

Professor Abel of Jena is reported to be in disagreement with Dr. Karl Imhoff in regard to the **re-use** of **sewage**[76]. Professor Abel is reported to have stated in reference to the experiments of Wilson and Goudey in Los Angeles that "something of the sort might do in Los Angeles—that is, in a land whose inhabitants are the most lacking in culture of all the districts in the world claiming civilization—but for Germany let them decline it absolutely." Dr. Imhoff on the other hand claimed that American water works technique

was more advanced than the German, that interest in the potability of water was great and that the Germans had reason to make the American experiments profitable to themselves, and could not dismiss them with a remark about a lack of culture. The fact should not be forgotten that the American process of chlorination had since 1910 won through with great economic and sanitary success against the greatest opposition by many hygienists in Germany.

Stevenson[8] discussing the **cost of sanitary surveys of streams** in Pennsylvania observed that mere inspection costs about $3.30 per mile of stream, while a thorough stream survey costs about $100 per mile. Soenen[82] assembles a collection of proposals for the study of stream conditions by analytical procedures.

Articles of Special Interest:

Detergent effect of alkali salt solutions. Sodium silicates best, Snell[44].

Reaction of **distilled water** normally pH 5.6 to 5.8, Truog[67].

Agar plate counts should be duplicated within 5%, counts of others within 10%, Schacht and Robertson[9].

Water borne typhoid fever outbreaks, 1920-1930, Wolman and Gorman, reviewed by Whipple[60].

Correcting water supply defects in **Missouri,** Bosch[131].

Maintaining pure water supplies in **Connecticut,** Scott[13].

Lake Erie-Niagara River pollution problem[40].

Water supply and sanitation in **French colonies,** Kerouault[87].

Stream pollution in **Switzerland,** Acklin[83].

Improvement of the water of the river **Espieres,** Soenen[81].

Polhution of water, soil and sub-soil, Vignerot[80].

Interruptions of water supplies, Mowry[n106].

Hydrology of Oregon, Rogers and Merryweather[54].

British **rainfall** in 1930 was 115% average[n90].

"Drought" or **"Drouth"**[n114].

University of Iowa's Institute of **Hydraulic Research**[n104, n128].

Is there such a thing as **hydrogeology?** Imbeaux[84].

Drinking water supply of **cooled water** for miners[n97].

Installing a **water cooling** system, Starbuck[20].

Hogan Baths at Montreal will have pool 30x75 feet [n15].

Hackney's new Branch **Slipper Baths**[79].

Lead-lined garden pool[21].

Meeting of the **North Carolina** Section, American Water Works Association[112].

Meetings of the **Virginia** Water and Sewage Association[110].

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n4. 8,000,000 Gallon Spring 2 Blocks from Court House Supplies Water to Cedartown, J. E. Rainwater, p. 7.
5. Piping a Pumping Station, Orville B. Carlisle and Duane F. Kennedy, pp. 79-83.
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n7. Section of Chicago's Original Water Line Laid in 1861 and Abandoned Recently on Account of Other Underground Construction, p. 139.

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46. Developing Wells With Compressed Air, Part II, "Open Well" or "Surging" Method, H. O. Williams, pp. 1-3.
47. The Engineer's Part in Developing a Well Supply, Herbert L. White, pp. 1, 6, 6 and 7.
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48. Hydraulics of Wells in Sand and Gravel Formations, H. O. Williams, pp. 1-3.
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49. A Report on Failures of Water Mains, H. E. Stilgoe, Chairman, A. B. E. Blackman, S. C. Chapman, J. R. Davison, Fred J. Dixon, F. W. McCaulay, J. K. Swales, A. T. Hobbs, Secretary (Institute of Water Engineers), pp. 2067-2084.
50. Problems of Ground Water in Florida, David G. Thompson, pp. 2085-2100.
51. Standby Charges for Water Works, C. E. Thatcher, pp. 2101-2105.

52. A New Distributing Reservoir in Syracuse (N. Y.), E. P. Stewart, pp. 2106-2112.
53. Purification of Water Supplies, Richard G. Tyler, pp. 2113-2119.
54. Hydrologic Resources and Phenomena of Oregon, H. S. Rogers and F. Merryweather, pp. 2120-2128.
55. Color Removal in Pacific Coast Water Supplies, Paul F. Bovard and Kenneth Shibley, pp. 2129-2137.
56. Tentative Draft of Standard Specifications for Steel Standpipes and Elevated Tanks, Committee 7-H, G. Gale Dixon, Chairman, pp. 2138-2167, Discussion to p. 2180.

Journal of the New England Water Works Association, Vol. 45, No. 3 (September, 1931.)

*57. The Law of Interstate Waters and Its Application to the Case of the Delaware River, Thaddeus Merriman, pp. 199-266.
*58. Diversion of Interstate Waters for Domestic Water Supply, Frank E. Winsor, pp. 267-298.
59. General Discussion of Merriman and Winsor Papers on Interstate Waters for Domestic Water Supply, pp. 299-311.
60. Significance of Water Borne Typhoid Fever Outbreaks. 1920-1930, Abel Wolman and Arthur E. Gorman, Williams and Wilkins Co., Baltimore. Review by Melville C. Whipple, pp. 312-313.

Military Engineer, Vol. 24, No. 133 (Jan.-Feb., 1932.)

61. Water Purification in the Middle West, Paul Hansen, pp. 24-26.

Power, Vol. 74, No. 24 (December 15, 1931.)

62. Selection and Operation of Centrifugal Pumps, M. Phillips, pp. 861-863.
63. Compressed Air Used to Clean Blowdown Line, Anon., p. 863.
n64. Boiler Water Conditioning (A Letter), L. R. Baker, p. 873.

Power Plant Engineering, Vol. 35, No. 24 (December 15, 1931.)

65. Feedwater Treatment Shows Advancement, Anon., pp. 1188-1189.

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66. Design of Large Pipe Lines, Discussion of paper by Herman Schorer in Issue of September, 1931, pp. 1561-1573.

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67. Testing the Reaction of Distilled Water, Emil Truog, pp. 633-634.

Science, Vol. 75, No. 1932 (January 8,1932.)

68. A Theory of Disinfection, M. L. Isaacs, pp. 46-48.
69. Progress in Western Duck Sickness Studies, E. R. Kalmbach, pp. 57-58.

Scientific American, Vol. 146, No. 1 (January, 1932.)

70. New Dam Reconditioning Method, Alf. B. Bryn, p. 12.

Surveyor, Vol. 80, No. 2079 (November 27, 1931.)

71. Reservoirs (Safety Provisions) Act, 1930 (A Letter), Percy Griffith, p. 535.

Surveyor, Vol. 80, No. 2081 (December 11, 1931.)

72. Capetown Waterworks Extension, D. E. Lloyd-Davies, p. 570.
73. Repairs to Old Earth Embankment at Macclesfield, G. W. Cover, pp. 573-574.
74. The Transmission of Disease by Water. A. W. Burtt, p. 579.
75. Sydney, New South Wales, Water Supply; Construction, Testing and Strengthening of a Pressure Tunnel, Gerald Haskins, p. 580.
76. Purified Sewage as Drinking Water; Professor Abel and Doctor Imhoff in Disagreement, "Cyclops," pp. 583-584.

Surveyor, Vol. 80, No. 2082 (December 18, 1931.)

77. Discussion of "Repairs to Old Earth Embankment at Macclesfield" by G. W. Cover, pp. 599-600.
78. Discussion of A. W. Burtt's paper, "The Transmission of Disease by Water," pp. 600-601.
79. Hackney's New Branch Slipper Baths, Anon., p. 602.

La Technique Sanitaire et Municipale, Vol. 26, No. 10 (October, 1931.)

80. La pollution des cours d'eau, du sol et du sous-sol par les eaux usées. Mesures prises et à prendre pour y obvier, Vignerot, pp. 292-297.
81. Vers une solution satisfaisante du la question de l'épuration des eaux de l'Espièrres, A. Soenen, pp. 297-304.
82. Contribution à la recherche des methodes uniformes pour l'éxamen technique, 1.) de la pollution des voies hydrauliques, et 2.0 des effluents de l'épuration des eaux usées urbaines ou des eaux résiduaires industrielles, A. Soenen, pp. 304-317.
83. La pollution des cours d'eau et les solutions préconisées pour y obvier au point de vue des odeurs degagées dans la traversée des agglomerations et en tenant compte des conditions existant en Suisse, O. Acklin, pp. 317-329.
84. Où en est hydrologie? Ed Imbeaux, pp. 333-342.
85. La station d'épuration des eaux de la ville balméaire de Knocke-sur-Mer (Belgique), Cautermann, pp. 342-343.
86. Considerations sur les maladies d'orgine hydrique aux Colonies, Brau, pp. 346-357.
87. Les adductions d'eau et l'assainissement dans la France d'outremer, Kerouault, pp. 357-379.
88. L'epuration dés eaux destinées à l'alimentation des Colonies, Casteels, pp. 379-383.

La Technique Sanitaire et Municipale, Vol. 26, No. 11 (November, 1931.)

89. Les Eaux de Paris, Anon., pp. 402-409.

Water and Water Engineering, Vol. 33, No. 397 (December 21, 1931.)

n90. British Rainfall in 1930, Anon., p. 608.
n91. Water Supply of the Metropolis, Anon., p. 608.
92. Effect of Organic Substances on Removal of Manganese from Water, B. A. Adams, pp. 609-610.
93. Hoof Dams, A. M. A. Struben, pp. 611-617.
94. Devizes Water Supply: New Reservoir, Rising Main and Pumping Plant, Charles G. Barrett, pp. 617-620.

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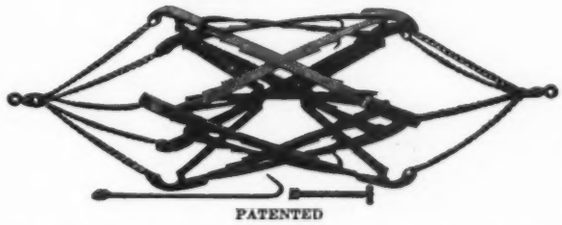

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Office of City Engineer

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Bids Wanted: Streets and Roads

Del., Dover— **Feb. 9**
For grad., fill., lay. sidewalks, grubb., clear, etc., in New Castle Co., Sussex, Kent Cos.; driving piles Contr. "X."—State Hwy. Dept., Dover.

Ill., Chicago— **11 a. m., Feb. 8**
Torpedo sand, for Bureau of Sts. during 1932.—Dept. of Pub. Wks., Room 406, City Hall.

Ind., Jeffersonville— **10 a. m., Feb. 15**
Constr. Walter Schroeder Rd.; est. cost $72,741.—Auditor, Clark Co. Court House.

Ky., Frankfort— **2 p. m., Feb. 23**
Surfacing rds. in Harrison, Hart and Meade-Hardin Cos.; pav. rd. Henderson Co.—Ky. State Hwy. Comn., Div., Constr. Frankfort.

Md., Baltimore— **Feb. 9**
Conc. pav. 1.5 mi. Francis Scott Key Hwy., Cont. Cl.-92-54, Carroll Co.—State Roads Comn., Federal Reserve Bank Bldg., Balto.

Md., Baltimore— **Feb. 10**
For sh. asph. pav. 9,800 sq. yds., Cont. 609.—Dept. Pub. Wks., Bureau Hwys., Municipal Bldg., Baltimore.

Mich., Adrian— **10 a. m., Feb. 24**
Grad. and drain. structs. 0.434 mi. Hillsdale and Lenawee Cos. (Note change in date). Office Div. Engr., H. G. Oakes, Plymouth.

Mich., Ann Arbor— **10 a. m., Feb. 25**
Grad. and drain. structs. 5.242 mi. Washtenaw Co.—Office Div. Engr., H. C. Oakes, Plymouth.

Mich., Cadillac— **10 a. m., Feb. 9**
Grad., drain. structs., conc. surfac. 0.241 m. M-131 Vill. of Harbor Springs, Emmet Co.—A. L. Burridge, Div. Engr.

Mich., Cadillac— **10 a. m., Feb. 24**
Gravel. 3.010 mi. Wexford Co.—Div. Engr., A. L. Burridge, Cadillac.

Mich., Escanaba— **10 a. m., Feb. 9**
Grad., drain. structs. 4.268 mi. M 35, Delta Co.; same 1.189 mi. US-2, Dickinson Co.—J. T. Sharpensteen, Div. Engr., Escanaba.

Mich., Kalamazoo— **10 a. m., Feb. 10**
Grad., drain. structs. 5.485 mi. US-12, Kalamazoo Co., 2.500 mi. US-131.—State Hwy. Dept., 309 McNair Bldg., Kalamazoo (W. J. Kingscott, Div. Engr.)

Mich., Monroe— **Feb. 11**
Widen. grade of Telegraph Rd.; est. cost $25,000.—State Hwy. Comsn., Grover C. Dillman, Comr., Lansing.

Mich., Ontonagon— **10 a. m., Feb. 23**
Two-course gravel. 5.179 mi. M-64, Ontonagon Co.—Div. Eng. Office, J. T. Sharpensteen, Escanaba.

Mich., Plymouth— **10 a. m., Feb. 11**
Widen. grade. length. drain. structs. 8.395 mi. Monroe Co.—H. G. Oakes, Div. Engr., Plymouth.

Minn., St. Paul— **10 a. m., Feb. 16**
Grad. 68.50 mi., involv., 2,678,000 cu. yds. excav., and 31,000 cu. yds. swamp fill.—State Hwy. Dept., C. M. Babcock, Comr. Hwys., 1246 University Ave., St. Paul.

Minn., Minneapolis— **2 p. m., Feb. 17**
Grad. part of Co. Rd. No. 51, and part of Co. Rd. No. 58.—Bd. of Comsrs., Al. P. Erickson, Co. Aud., Court House.

Miss., Byhalia— **Feb. 13**
Work. and maintenance approx. 19 mi. gravel rd. for 1932.—Commrs. of Barton-Byhalia Rd. Dist., Citizens Bank.

Miss., McComb— **Feb. 12**
Conc. curb. and gutter in cemetery.—Hollywood Cemetery Assn., Office of City Clk., City Hall.

O., Amherst— **1 p. m., March 1**
Const. either sandstone or conc. sidewalks, steps, br. & dam, etc. at T. B. Hospital, Leavitt and North Ridge Rds. —Co. Comrs., Bd. of Trustees, F. L. Ellenberger, Clk., Elyria.

O., Ashland— **2 p. m., Feb. 16th**
Grad., drain. and widen. Mansfield-Ashland Rd., 2.50 mi.; est. cost $77,729.—Dept. of Hwys., O. W. Merrell, Dir.

O., Cincinnati— **12 noon, Feb. 9**
Grad., drain., vitr. pipe sew., etc. LeBlond Ave., Terrace Ave., Badgeley St., Fowler St., etc.—C. A. Dykstra, City Mgr.

O., Cleveland— **11 a. m., Feb. 9**
Improv. Green Rd., involv. 6,700 cu. yd. excav., 15,130 sq. yd. 3 in. brk. pav., 15,130 sq. yds. 9 in. conc. base, etc.—F. J. Husak, Clk., Co. Comrs.

O., Coshocton— **2 p. m., Feb. 16**
Grad. and pav. with traffic bound. matl. 4¼ mi. in Tuscarawas and Franklin Twps.; est. cost $76,105.—Dept. Hwys., O. W. Merrell, Dir.

Tenn., Nashville— **Feb. 12**
5 hwy. projs, Maury, Sullivan, Cooke, Henry and Moore Cos. involv. expend. $125,000.—State Dept. Hwys., and Pub. Wks., R. H. Baker, Commr., Nashville.

Va., Richmond— **10 a. m., Feb. 16**
Conc. pav. 0.5 mi. Rte. 31, Chesterfield Co.; soil 0.5 mi. Rte. 19, Fluvanna Co.; also 1.9 mi. soil Rte. 57, Halifax Co.—Dept. of Hwys., State Office Bldg., Capitol Square, Richmond.

Wis., Madison— **10 a. m., Feb. 9**
Gravel surfac., conc. surfac. grad. approaches of 7 grade separations.—Wis. Hwy. Comn., and Unemployed Commission, State Capitol Annex, Milwaukee.

Wyo., Cheyenne— **10:30 a. m., Feb. 9**
Grad. 48.564 mi. Fremont, Natrona, Lincoln Cos.; and base course surfac. 28.905 mi. Platte and Albany Cos.—State Hwy. Comn., Capitol Bldg., Cheyenne, Wyo.

To be of value this matter must be printed in the number immediately following its receipt, which makes it impossible for us to verify it all. Our sources of information are believed to be reliable, but we cannot guarantee the correctness of all items. Parties in charge of proposed work are requested to send us information regarding it as soon as possible, also corrections of any errors discovered.

Sewage and Sanitation

Md., Baltimore— **Feb. 10**
Storm water sew. Cont. No. 171.—Dept. Pub. Wks., Bureau of Sews., Municipal Bldg.

N. Y., Camillus— **3 p. m., Feb. 11**
Sani. sewerage sys. and treatmt. plant, furn. install. mach. & equipmt. in pump. house of sew. sys.—Bd. of Trustees, Vill. of Camillus, Owen E. Hayes, Vill. Clk., City Hall.

N. Y., New City— **2 p. m., Feb. 24**
Const. sews. and water lines, Farm Colony Bldg., Letchworth Village, Thiells, Rockland Co., N. Y.—Dept. Mental Hygiene, State Office Bldg., Albany.

N. Y., White Plains— **11:30 a. m., Feb. 15**
Comfort stas. No. 5 and 6, opposite sides Bronx Parkway exten. nr. Highland Ave., Vill. Peekskill, Westchester Co., N. Y.—Westchester Co. Park Comn., 72 West Pondfield Rd., Bronxville.

O., Cincinnati— **12 m., Feb. 11**
Sew. along Water Works Dr., Eden Park.—Bd. of Park Comrs., John K. Rose, Secy., 2005 Gilbert Ave., Cincinnati.

O., Cleveland— **12 m. Feb. 9**
Sews. and appurts. Dugway Creek.—M. W. Garnett, City Engr.

O., Cleveland— **11 a. m., Feb. 16**
4,536 cu. yds. sew. trench excav., 1 special drop m'hole, 1 m'hole over culvt. —Co. Comrs., J. F. Husak, Clk.

Water Supply

Minn., Bemidji— **Feb. 15**
Developt. 1,000,000 gals. per day underground water supply—(former bids rejected)—Belle Denley, City Clk., City Hall.

Minn., Sleepy Eye— **7:30 p. m., Feb. 19**
Const. one 16 in. well and one 20 in. well.—A. J. Thomas, City Recorder, City Hall.

N. Y., Buffalo— **2 p. m., Feb. 23**
Water supply sys. at Thomas Indian School, Iroquois, Erie Co., N. Y.; est. cost $23,922—Executive Dept., F. L. Morris, Supt., Div. of Standards and Purchase, Capitol, Albany.

N. Y., Long Island City— **2 p. m., Feb. 17**
Completing Contract No. 1253, Driven Wells, Brooklyn State Hospital, Creedmoor Div., Queens Co.—Dept. Mental Hygiene, State Office Bldg., Albany, N. Y.

N. Y., Riverhead— **2 p. m., Feb. 17**
Install. new screens in exist. wells at Central Islip State Hospital, Central Islip, Suffolk Co.—Dept. of Mental Hygiene, State Office Bldg., Albany.

Pa., Harrisburg— **2 p. m., Feb. 24**
Const. of service lines, includ. conc. tunnel, sani. sew., pipe, expansion joints, M'holes, pipe conduit, tunnel extension, etc. for Polk State School, Polk, Pa., State Teachers College, Mansfield, and State Teachers College, Clarion.—Secretary of Property & Supplies, John L. Hanna, Capitol Bld., Harrisburg.

Tex., San Antonio— **Feb. 12**
Water softener.—Quartermaster, Normoyle, Q. M. Depot, San Antonio.

Bridges

Fla., Tallahassee— **Feb. 15**
Const. conc. deck girder span. br., steel I-beam br., creo. pile bents, conc. box culvts., etc., in counties.—State Rd. Dept., Tallahassee, H. H. Wells, Chn.

Ga., Blairsville— **10 a. m., Feb. 10**
Const. br. on Dahlonega-Blairsville Rd., State Aid Proj. No. 310, Union Co.—State Hwy. Bd. of Ga., No. 2 Capitol Square, Atlanta.

Ga., Clyde— **10 a. m., Feb. 10**
Const. 4 bridges, on Clyde-Savannah Rd., State Aid Proj. 591, Bryan Co.—State Hwy. Bd. of Ga., 2 Capitol Square, Atlanta.

Ill., Pekin— **10 a. m., Feb. 10**
12 I-Beam spans Sect. 1B-15d, Tazewell Co.—Bureau of Co. Rds., Court House.

Ill., Springfield— **10 a. m., Feb. 20**
Constr. rein. conc. box culvt. and steel spans Wabash Co., Sec. 1 B-M. F. T., and 7 rein. conc. box culvts. Sec. 2 S-M. F. T. —Co. Supt. Hwys., Court House, Mt. Carmel.

Ind., Indianapolis— **10 a. m., Feb. 16**
Constr. 18 bridges, Bartholomew, Delaware, Boone, Montgomery, Posey and Vanderburgh Cos.—State Hwy. Comn., J. J. Brown, Dir., State House Annex, Indianapolis.

Ind., Indianapolis—
Will probably readvertise for new bids for 120x40 ft. rein. conc. br. over White River; est. cost $30,000.—J. J. Brown, Dir., State Hwwy. Comn.

Md., Frederick— **Feb. 9th**
Substruct. and approaches for br. over Monocacy River.—Maryland State Rds. Comn., Federal Reserve Bank Bldg., Baltimore.

Mich., Cadillac— **2 p. m., Feb. 10**
Constr. rein. conc. br. on M-76. Crawford Co.—Office Div. Engr. A. L. Burridge, Cadillac.

Mich., Caro— 2 p. m., Feb. 25
Const. br. of one 75-ft. span on M-81. Tuscola Co.—State Hwy. Dept., Resident Office, 504 Eddy Bldg., Saginaw (H. W. Hagaman, Div. Engr.)

Mich., Charlotte— 2 p. m., Feb. 23
Br. of three 60-ft. spans Contrs. No. 2 and 3, Eaton Co.—Eaton Co. Rd. Comn., Charlotte, Mich., H. G. Oakes, Div. Engr.

Mich., Howell— 2 p. m., Feb. 24
One 40-ft. bridge and 0.406 mi. grad. and drain. structs. Livingston Co. on U. S. 16.—Div. Engr., H. G. Oakes, Plymouth.

Mich., Saginaw— 2 p. m., Feb. 9
Constr. rein. conc. br. of three 65-ft. spans in Saginaw Co.—Saginaw Co. Rd. Comn., Saginaw.

Minn., St. Paul— 10 a. m., Feb. 16
Constr. Br. 5170-A, Koochiching Co., and Br. 5182, Brown Co.—C. M. Babcock, Comr. of Hwys., 1246 University Ave.

Neb., Columbus— 2 p. m., Feb. 17
I-beam brs., conc. box culvts., span truss brs., span steel br.—Carl H. Hoge, Clk., Platte Co.—Court House.

O., Cincinnati— 12 m., Feb. 11
Culvt. No. 10, Five Mile Rd., Anderson Twp.—Co. Comrs., E. J. Dreihs, Clk. (E. A. Gast, Co. Engr.)

O., Columbus—
Bids rejected to have been opened Jan. 8th. brs. in Shelby Co., Hancock, Fulton and Erie Cos.—total cost $63,632.—O. W. Merrell, Dir., Dept. of Hwys.

Okla., Tulsa— Feb. 9
Widen. W. Tulsa Br. over Arkansas River.—State Hwy. Comsn., Sam Hawks, Chmn., Oklahoma City.

Va., Richmond— 10 a. m., Feb. 16
Rein. conc. beam span 127 ft. long Rte. 307, Appomattox Co.—Dept. Hwys., State Office Bldg., Capitol Square, Richmond.

Wis., Madison— 10 a. m., Feb. 9
100-ft. span steel truss Greene Br., Rock Co.—Wis. Hwy Comn. and Unemployed Comn., State Capitol Annex, Madison.

Wyo., Cheyenne— 10:30 a. m., Feb. 9th
Const. treated timber and steel, bridges in Fremont, Natrona, Big Horn, Lincoln Cos.—State Hwy. Comn., Capitol Bldg., Cheyenne.

Drainage and Irrigation

D. C., Washington— Feb. 10
Improv. drain. sys., conc. pav. in moat, point walls of terrace, Bancroft Hall, Naval Academy, Annapolis, Md.—Bureau of Yards and Docks, Navy Dept., Washington.

Ia., Clarinda— 1 p. m., Feb. 11
Constr. drain. in Dist. 26, Sec. 1, 2, 3, 4, 5 and 6.—Katherine Millen, Aud., Page Co. Court House.

N. J., Jersey City— 3 p. m., Feb. 11
Exten. of cast iron drain. from Hillside Rd., Hudson Co.—Bd. of Chosen Freeholders, Hudson Co., T. J. Wasser, Clk., Court House.

N. J., Mays Landing— Feb. 9
Dredg. Great Egg Harbor river for 2 mi. down from Mays Landing, $37,500 available.—Bd. Commerce and Navigation, Trenton.

O., Hamilton— April 1
Dredg. and some fills., Miami River—Miami Conservancy Dist. (Luke Brannon, Div. Engr., Cincinnati).

O., Sandusky— 2 p. m., Feb. 16
Ditch fill. Tiffin Ave., 1.8 mi. est. cost $18,500.—State of Ohio Dept. of Hwys., O. W. Merrell, Dir., Columbus (H. F. Gerold, Co. Engr.)

O., Tiffin— 10 a. m., Feb. 9
Constr. Ditch (Niederhouser) Jackson and Scott Twps.—Co. Comrs., H. Z. Hakes, Co. Engr.

Miscellaneous

Ia., Waterloo— 7:30 p. m., Feb. 17
Constr. 1,790 ft. lower wall, 1,635 ft. upper wall, E. bank of Cedar River, and 2 parks: est. cost $62,227.—City River Front Comm. care Hermann Miller, Chm., 622 Commercial St. (Nathan B. Barber, Engr., 619 Lafayette).

Md., Baltimore— Feb. 10
Terra cotta conduit.—Dept. Pub. Wks., Bureau of Mechanical Electrical Service, Municipal Bldg.

Mo., Kansas City— 12 m., Feb. 29
Test borings, 2,690 lin. ft.; and 100 lin. ft. open test pit, etc. Missouri River Valley nr. Garrison, N. D.—War Dept., U. S. Engr. Office, 707 Postal Telegraph Bldg., Kansas City.

Mo., St. Louis— 11 a. m., Feb. 17
Plac. 1,428,000 cu. yds. earthwk. in reconst. and enlarg. levee of Hartwell Drain. and Levee Dist., Greene Co., Ill., Illinois River.—U. S. Engr. Office, 428 Customhouse, St. Louis.

N. Y., Babylon— 2 p. m., Feb. 16
Hydraulic excav. on part 3B and Hydraulic fill on part 7 of Ocean Blvd., Nassau and Suffolk Cos.—Long Island State Park Comn., Administration Headquarters, Belmont Lake State Park, A. E. Howland, Chf. Engr.

O., Troy— 12 m., Feb. 15
Municipal light and power plant improvmts.—Geo. L. Smith, Ser. Dir., City Hall. (Froelich & Emery Engrg. Co., Engrs., 410 Second Natl. Bank Bldg., Toledo).

Pa., Pittsburgh— 12 m., Feb. 24
Const. 2 power houses 62x17x19 and administration bldg., at Lock 4, Monongahela River.—U. S. Engr. Office, Pittsburgh.

Contemplated Work: Streets and Roads

Neb., Tekamah—
Contempt. const. fed. and state aid hwy. which will be graveled, Burt Co.

O., Cincinnati—
Plans being drawn for widen. E. 5th St.; est. cost $1,250,000.—C. A. Dykstra, city manager.

O., Dayton—
Bids early in spring, surface treating 55 mi. rds.; est. cost $110,000.—W. O. Peace, Co. Surv., Dayton.

O., Youngstown—
Ordinance adopted for resurfacing Warren Ave.—Geo. Turner, City Engr.

O., Worthington—
Bids abt. Mar. 1st. widening Granville Rd.—A. E. Dunn., Clk., City Hall (Jennings-Lawrence Co., Engrs., Rolands Bldg., Columbus).

Sewage and Sanitation

Mich., Grand Rapids—
Contemp. for spring, const. storm relief sew.; est. expend. $1,750,000.—C. W. Darling, City Engr., City Hall.

Mich., Monroe—
City proposes to engage Hoad, Decker, Shoecraft and Drury, Engrs., Ann Arbor, to make another survey of general sewage problem and compare report with that made last year, to determine treatment system city shall use. Council will probably take definite action at next meeting.—John H. Eber, Clk.

N. Y., Scarsdale—
Contemp. sewerage sys. in Dist. 2, all sts. e. of Morris Lane.—A. Boniface, City Engr., City Hall.

O., Avon Lake—
Will prob. call bids abt. April 1st. vitr. and c. i. pipe 10 in. to 30 in., for storm sew.—Warden and Laundon, Engrs., Elyria Bldg., Elyria.

O., Cincinnati—
Contemp. soon const. storm water drain and fill. 74th St. northwardly to Mill Creek.—C. A. Dykstra, City Mgr.

O., Cleveland—
Bids abt. Feb. 10th. vit. pipe sew. Fay & Emily Sts.—M. W. Garnett, City Engr., City Hall.

O., London—
Will start wk. soon const. sew. thru Snyder property.—H. L. McCafferty, City Engr.

O., Springfield—
Contemp. const. sewage disposal plant, site not selected.—Ralph E. Garvin, City Mgr., City Hall.

O., Youngstown—
Ordinance adopted for sew. in Burlington St.—Geo. Turner, City Engr., City Hall.

S. C., Columbia—
Will probably introduce bill to permit So. Car. cities or towns to const. and operate sewage treatmt. plants.—A. E. Legare, State Sanl. Engr.

W. Va., Moundsville—
Contemp. const. 36 in. trunk sew. est. cost $39,500.—J. J. Sammons, City Engr.

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Water Supply

Md., Baltimore—
Contempt. const. water supply sys.; est. cost $7,500,000.—John H. Gregory, Consult. Engr., Johns Hopkins University, Baltimore.

O., Lisbon—
Contemp. const. reservoir, and state park, west fork of Beaver Creek, Williamsport; propose establish 15 or 20 more such park reservoirs thru state.—Dept. of Pub. Wks., T. S. Brindle, Dir., Columbus.

Pa., Altoona—
Have preliminary sketches for reservoir, Mill Run Valley, capy. 585,000,000 gals.; est. cost $1,500,000.—Samuel B. Tayler, Dir. Dept. of Parks (Fuller and McClintock, Philadelphia, Pa., Engrs.)

Bridges

Mich., Manistee—
Will probably call bids soon, for const. double bascule lift span of steel and conc. across Manistee River.; est. cost $250,000.—State Hwy. Dept., Grover C. Dillman, Comnr., Lansing.

O., Cleveland—
Preparing plans for w. approach and retain. walls, rein. conc. struct. steel br. Main Ave.; est. cost $350,000.—Wilbur, Watson and Associates, Consult. Engrs., 4614 Prospect Ave.

O., Dayton—
Contemp. joint co. hwy. br. probably two 150 ft. spans, steel truss type, present masonry pier and abutmts, to be conc. jacketed over Miami River.; est. cost $50,000.—E. H. Bagford, Surv., Court House, Miami Co.

O., Sandusky—
Recently organized Sandusky Bay Fish & Game association to obtain for Milan, O., erect. of Thomas A. Edison Memorial Br.—W. H. Reinhart, State Conservation Comr.

Pa., Harrisburg—
Will soon call for bids for new br. over Mahoning River at New Castle.—Secretary of Hwys. Lewis, Harrisburg.

Pa., Pittsburgh—
Contemp. improv. Panther Hollow Br.; est. $93,000; junction Railroad Br., Schenley Twp.; est. $82,000, incl. new floor, sidewalks, strength, trusses.—C. M. Bennert, City Co. Bldg., Engr.

Tex., Waxahachie—
Soon take bids 425 ft. rein. conc. br. over Mountain Creek; Ellis Co., est. cost $35,000.—A. C. Love, Engr., Ennis.

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Water Works and Sewerage, Vol. 78, No. 12 (December, 1931.)

n104. Institute of Hydraulic Research Opened at University of Iowa, Anon., p. 350.
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116. Gas-fired Boilers Furnish Power for San Antonio Pumps, J. B. Nealey, pp. 1721-1722 and 1736.
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Equipment for Constructing and Maintaining Low-Cost Surfaces

(Continued from Page 18)

Equipment for the foregoing operations includes:

Motor *graders* with *scarifier* for loosening road surface.

Disc *harrows* for mixing aggregates with bituminous oil.

Tractors for pulling disc harrows and graders.

Graders for shaping and smoothing.

Distributors for applying bitumen.

Rollers are used for compaction (but in some cases traffic does the compacting).

A list of equipment for road-mix jobs of the graded aggregate type, as used in a western state, follows:

Four 15 h.p. motor graders (8 ft. blade), crawler type, with scraper attachments, for processing.
Two offset disc harrows (9 ft. width) for mixing after applying oil.
Two 15 h.p. crawler type tractors for pulling disc harrows.
One 6-ft. rubber-tired grader used in finishing.
One 10 h.p. rubber-tired tractor for pulling 6-ft. grader.
One 25 h.p. steam boiler for heating oil in tank cars.
One 1,000 gal. oil distributor.
One 1½-ton service truck.
One light automobile for foreman.

The committee made several suggestions concerning this equipment, among them that methods or equipment are needed for (1) quickly determining the gradation of aggregates on the road and for adjusting the rate of application of bitumen to changes in gradation; (2) drying aggregate more quickly at low cost; (3) more thoroughly mixing bitumen and aggregates for the road in less time; (4) overcoming the unfavorable effects of moisture and cool weather on the mixing process; and (5) constructing road mix types using fine aggregates (passing a ¼ inch screen).

The coarse aggregate type is made as follows: Prepare foundation by scarifying with suitable *scarifer* attachments, reshaping with *blade graders* and compacting with *rollers;* or by building up the base with bitumen and aggregate, either premixed in a *mixer* or mixed in place on the road. Then apply prime coat by *pressure distributor* if the surface has not previously been treated with bitumen. Spread aggregates through the back end of a dump truck or through the box type of *stone spreader.* (*Blade graders* are reported as good for finally spreading aggregates to required depth.) Apply first mixing coat of bituminous material from pressure distributors operating on pneumatic tires, and mix by motor driven blade graders, blade graders drawn by truck or tractor, or by motor driven *maintainers.* (Spring tooth *harrows* are said to give excellent results.) Then apply second mixing coat of bituminous material from distributor, and mixing and spread by graders and maintainers, and roll with a heavy roller (although lighter and smaller rollers have been used with good results). Then fill surface voids with cover-size aggregate by brooms, roll and apply seal coat of bituminous material. Then cover with chips from *chip spreaders* and drag with maintainers or long-base drags, and roll to a finished surface.

Among suggestions relative to equipment for this type of road mix are the following:

Machines used for mixing must be strong enough to handle the aggregate, have a long wheel base, and a tractive power plant capable of moving the apparatus smoothly and evenly.

For large jobs, the best combination seems to be a maintainer having several mixing blades set in a long frame and pulled by a tractor of ample power. Motor graders have been successfully used for mixing this type, but require more trips over the road and more care in their operation to obtain best results. A heavy grader pulled by a strong tractor will do very good work in the hands of a skillful operator. Graders hauled by trucks or tractors have also been used, although truck hauling is generally not so satisfactory, since the grader cannot be operated to capacity and more trips over the road are needed. Drags when used for mixing operations are not as efficient as maintainers or graders. In some localities the cover on the seal coat is dragged with good results by using a sled drag before rolling. The use of a spike-tooth harrow for road mixing is not generally recommended, as it tends to bring the large stone to the top of the mix and produces a very open top. A spring-tooth harrow is said to be much superior to the spike-tooth type. Disc harrows are used with good results. Multiple-blade drags and maintainers of various types for mixing which have appeared on the market in recent years are generally satisfactory. Developments in mixing devices are still probable and needed.

Rolling is an essential operation and the ordinary three-wheel, ten-ton macadam roller gives excellent results.

(To be continued)

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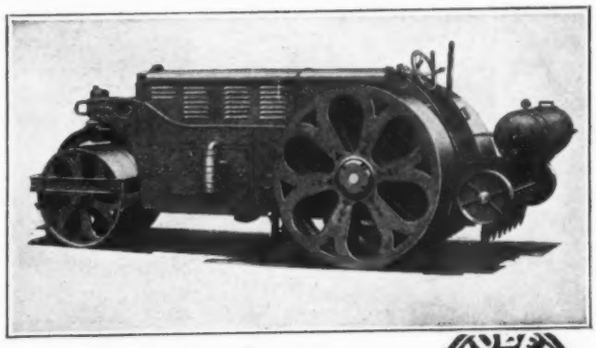

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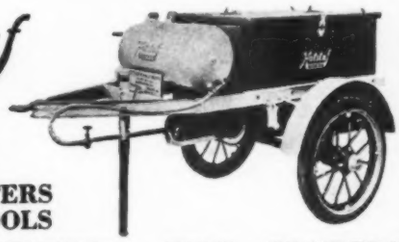

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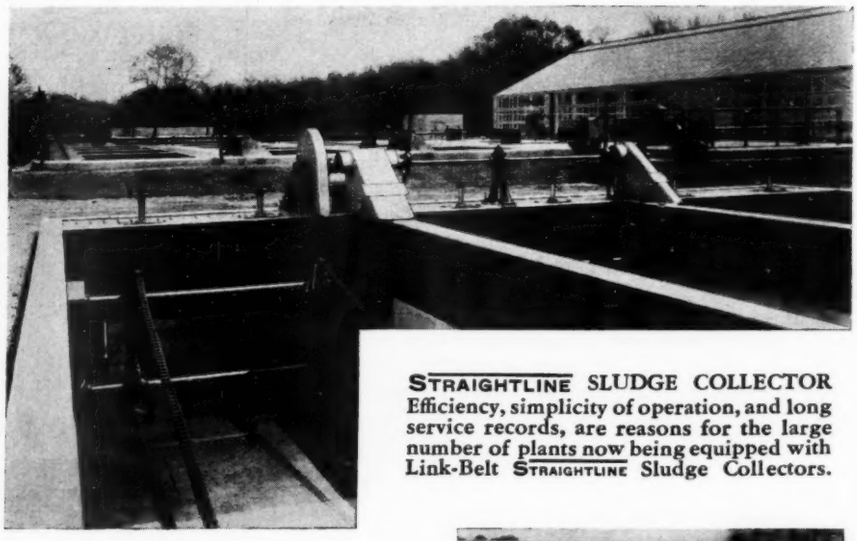

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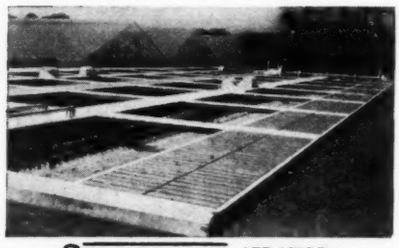

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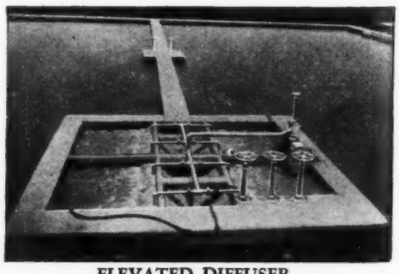

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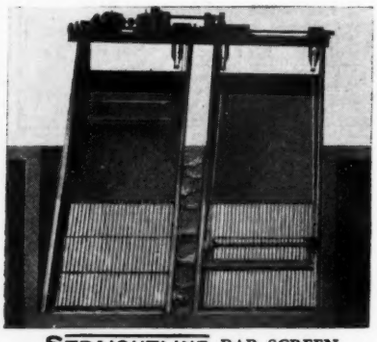

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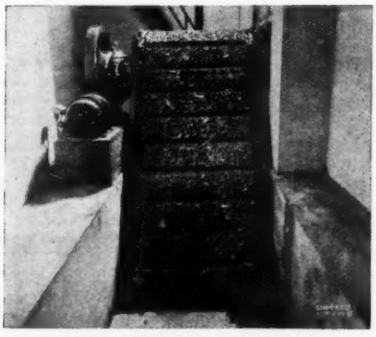

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ENGINEERING SOCIETIES

American Road Builders' Association

The convention and road show held this year in Detroit was notable for the comprehensive and diversified exhibits of road building and maintenance equipment and material. Particular emphasis was given to low cost road construction and maintenance, and the showing of motor trucks, in which 90 per cent of the truck manufacturers were represented with extensive displays.

In the 40 convention sessions the problems of construction and maintenance, traffic, motor freight, and other subjects related to highway activities were thoroughly aired and innumerable recommendations made.

At the general meeting on road and street planning, President Hoover contributed the statement that "the American Road Builders' Association is rendering an important public service not only in extending the highway system of the country, but in connection with an increased road building program as a means of employment. Road building by federal, state and city agencies is a major factor in unemployment relief." The meeting mobilized state, county and officials, engineers, contractors, commercial highway users, and manufacturers to combat any tendency to slow down construction projects in the name of economy, and the effort to divert to other uses than road and street construction and maintenance the tax money derived from motor vehicles.

Thos. H. MacDonald, chief of the U. S. Bureau of Public Roads, in an address at the planning meeting said that "the cost of road building is now 45 per cent below the 1924 prices. The diversion of highway revenue taxes for other than state highway purposes is now $150,375,000 annually and the tendency to reach into these special highway taxes is the most alarming one with which we have to contend so far as the future of a stable and adequate road program is concerned."

The two developments in motor vehicles of major importance to the public pocketbook and better service, according to Mr. MacDonald, are the development of better pneumatic tires and the redesign of heavy motor vehicles to distribute the load on more wheels. "From the standpoint of the future of highway building, regardless of how commodities or people are carried by the various public transportation agencies, no matters now in controversy will affect more than a minor percentage of the use of the highways," he said. "Long distance highway traffic has little effect on the necessity for road improvement or the volume of use of highways."

Many concurrent meetings of other associations were held covering subjects such as the technology of asphalt, and the coordination of motor freight transport through the many state hauling associations represented.

T. H. Cutler, chief engineer of the Missouri highway department, was elected President of the American Road Builders' Association to take office in May. The City Officials' Division elected R. B. Brooks, Director of Public Service, St. Louis, as President, and the County Highway Officials' Division elected W. O. Washington, County Engineer, Brownsville, Texas.

The location of the next road show will be determined at the May meeting of the Association in Washington, D. C., the national headquarters.

New York State Sewage Works Association

The Fourth Annual Meeting of the New York State Sewage Works Association was held at the McAlpin Hotel in New York City on January 19, 1932. One hundred and twenty members and guests were registered. At the business meeting J. L. Barron (White Plains), A. F. Dappert (Albany) and L. L. Luther (Freeport), were elected to the Executive Committee in place of E. Devendorf, C. A. Holmquist and John F. Skinner, whose terms of office expired. Mr. Skinner continues as advisory member of the Executive Committee for the coming year. Professor E. B. Phelps of New York City was elected President and A. F. Dappert of Albany, Vice-President. A. S. Bedell, State Department of Health, Albany, was reappointed Secretary-Treasurer.

At the morning session L. C. L. Smith, engineer member of the Sanitary Commission of New York City, gave a very interesting paper on the "Governing Features of the Sewage Treatment Plan for New York City." This was followed by a symposium "Sludge Handling," in which W. Donaldson spoke on "Activated Sludge," Fred J. Biele on "Sludge Pumping," W. Gavett on "Sludge and Gas Production," G. E. Hill on "Sludge Drying," and R. S. Rankin on "Sludge Collection from Settling Tanks." M. M. Aboul Ela of the Municipal Engineering staff of Alexandria, Egypt, spoke briefly on the "General Problem of Sewage Disposal in Egypt," and his interest in the sewage treatment works in this country.

At the luncheon Dr. Carl E. Buck of the American Public Health Association gave a very interesting talk on "Recent Developments in Public Health Administration." C. A. Emerson, chairman of the Board of Control of the Federation of Sewage Works Associations, spoke on the work of the Federation.

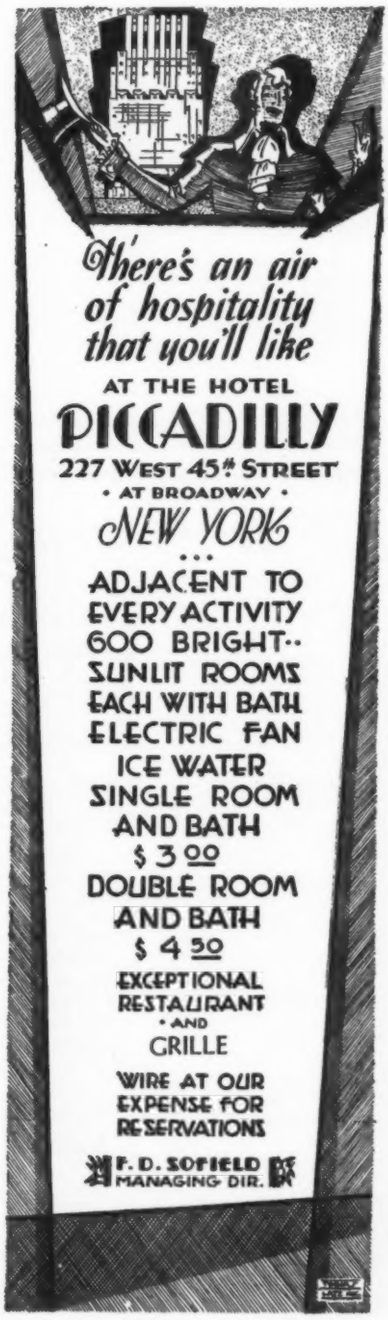
At the Round Table discussion in the afternoon session, J. F. Skinner led the discussion on "Sewage Sludge as a Fertilizer." Earl Devendorf opened the discussion on "New Kinks in Plant Operation," and L. H. Enslow led the discussion on "Chlorination for B. O. D. Reduction."

In the evening members and guests of the Association joined with the Sanitary Engineering Division of the American Society of Civil Engineers in the annual dinner.

The next meeting of the Association will be held in Buffalo, N. Y., on June 10-11, 1932.

Maryland-Delaware Water & Sewage Ass'n.

The sixth annual conference of this association will be held in the Municipal Auditorium, Cumberland, Md., April 12 and 13.



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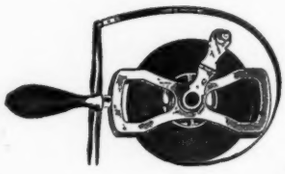

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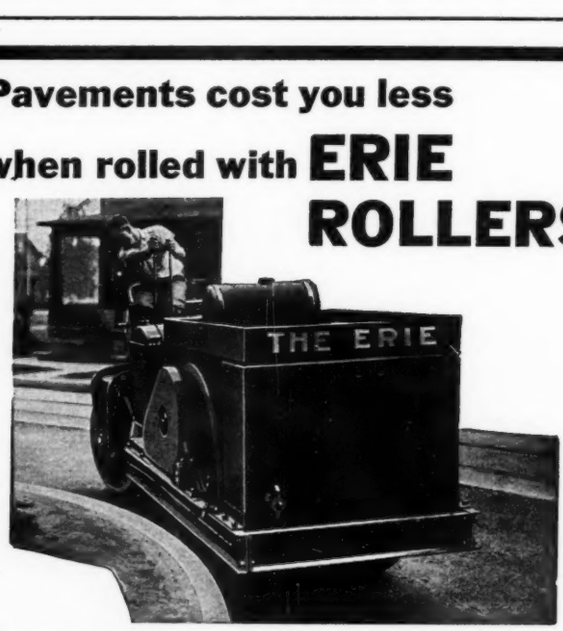

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IT is a good practice to check this list regularly because descriptions of new bulletins are always being added.

Construction Materials and Equipment

Accessories for Motor Trucks

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

9. Illustrated manual No. 11 describes "Hotstuff," the master oil burning heater. The only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate. J. D. Farasey Mfg. Company ,Cleveland, Ohio.

Asphalt Rollers

12. How to use Rollers to Save Tamping Costs. 16-page booklet gives details and also specifications of the Erie Roller. Issued by the Erie Machine Shops, Erie, Pa.

Bins and Hoppers

20. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Material Handling Buckets, showing the various types, sizes and uses for which they are intended and construction features and other valuable bucket information. A complete catalog on all types of Material Handling Buckets will also be furnished on request.

Bituminous Road Paver

25. Specifications and description of new Paver that gathers, proportions, mixes, spreads and compacts bituminous road in one continuous operation offered by Barber-Greene Co., Aurora, Ill. Ask for Bulletin BPF.

Clamshell Buckets

27. Clamshell Buckets, showing the various types, sizes and uses for which they are intended, and construction features and other valuable bucket information. A complete catalog on all types of Clamshell Buckets will also be furnished on request. The Owen Bucket Company, Cleveland, Ohio.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subjects suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 61 Broadway, N. Y. C.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Bridges, Culverts and Concrete Products." It includes reports from the Highway Research Board, the Bureau of Public Roads and State Highway Departments. Columbia Products Co., Barberton, Ohio.

Concrete Handling

40. Pouring concrete with portable and permanent belt conveyors on bridges, dams, buildings, locks, sewers, tunnels, etc., is described in a generously illustrated booklet, "CONCRETE HANDLING," by Barber-Greene Co., Aurora, Ill.

Concrete Mixer

44. Concrete Mixers, both Tilting and Non-Tilting types, from 3½s to 84s size, The Jaeger Machine Company, Columbus, Ohio.

Crushers

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Galion Iron Works & Mfg. Co., E. Jeffry, Mfg. Co., Columbus, Ohio.

Excavating Buckets

73. Excavating Buckets — shows the various types and sizes, the uses for which they are intended, construction features and other valuable bucket information. A complete catalog on all types of Excavating Buckets will also be furnished on rerequest. The Owen Bucket Company, Cleveland, Ohio.

Finishing Machines and Screeds

75. High Speed Screeding and Finishing—the use of single and tandem screeds and tamper attachment for high speed production on concrete and bituminous pavements, city streets and highways—32 pages. The Lakewood Engineering Company, Columbus, Ohio.

Graders

77. "Blade Graders" is a 48 page booklet, recently published by the Caterpillar Tractor Co., Peoria, Ill., giving the complete details of "Caterpillar" graders.

78. A 28-page bulletin describes the Austin 101 Leaning Wheel grader and its application for road construction and maintenance, heavy ditching and grading, bank sloping and scarifying. Austin-Western Road Machinery Co., 400 N. Michigan Avenue, Chicago, Ill.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Joint Filler and Line Marker

88. Bulletin No. G-9 issued by Littleford Bros., 452 E. Pearl St. Cincinnati, Ohio, describes and illustrates their new No. 91 Joint Filler which is used to fill horizontal and center joints with hot asphalt. It can be equipped to apply an asphaltic center line as it fills the center joint. This bulletin also describes the Littleford Traffic Line Marker.

Joint Filling Pot

89. A supplement to Bulletin No. E-5 has been issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describing their cone-shaped crack filling pot No. 86-B. The chief feature of this pot is that it is springless—there is no mechanism to get out of order. It is used to fill cracks and joints in concrete pavements and interstices in brick or granite block pavements.

Lanterns and Torches

90. Dietz Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Dietz Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, Philadelphia.

100. Materials Handling and Positive Power Transmission Equipment, giving technical data, list prices and illustrations of this machinery. Link-Belt Co., Chicago, Ill. General Catalog No. 500.

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Motor Trucks

107. "Operating Records for Motor Trucks" is one of the most complete record books available. It includes the necessary forms and directions for a very accurate and detailed accounting of Motor Truck operations. Dodge Brothers Corp., Detroit, Mich.

108. Four-wheel-drive trucks increase the range of truck operation and are particularly adapted for economy of operation in road building and maintenance. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

109. A 36-page booklet with 66 illustrations has just been issued by the Barrett Co., giving full information regarding the making, laying and maintaining of "Tarvia-lithic," the ready-to-lay pavement.

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. 24 pages. The Barrett Company, 40 Rector Street, New York.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book just issued by the Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

Road Construction

121. "Road Construction and Maintenance" takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. Cleveland Tractor Co. 1932 Euclid Ave., Cleveland, Ohio.

122. "Road Building Machines" is a handy reference booklet to the complete line of "Caterpillar" road machinery. 40 pages.

Road Machinery

125. The following publications cover a wide range of valuable and useful information on road-building machinery. Sixty Leaning Wheel Grader, the Super-Special Grader, the Motor Patrols, the Twenty-Planer, the Hi-Way Patrol Grader No. 3, the Ten Motor Patrol, and the Auto Patrol. Caterpillar Tractor Co., Peoria, Ill.

126. "Road Machinery." A sixty-four page data book describes road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade road rollers, steam or gasoline powered, 3 to 15-tons single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog. Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago.

127. "Road Machinery Illustrated." New illustrated bulletins on the motor rollers, three-wheel and tandem rollers, motor graders powered by Caterpillar, Twin City, Cletrac. McCormick-Deering and Fordson tractors, and straight and leaning wheel graders. Galion Iron Works & Mfg. Co., Galion, O.

Elevating Graders

129. An interesting booklet on Elevating Graders has recently been issued by the Caterpillar Tractor Co., Peoria, Ill.

Rollers

130. HERCULES, 6-cylinder road roller. Gasoline engine. Sizes 6, 7, 8, 10, 12 and 15 tons. Three speeds forward and backward. Catalogs and descriptive material. The Hercules Company, Marion, Ohio.

131. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Erie Machine Shops, Erie, Pa.

132. A 32-page book in four colors featuring a complete line of road rollers. 8¾ x 11, leatherette cover, numerous action pictures. Buffalo-Springfield Roller Co. of Springfield, Ohio.

133. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers and their uses. The Buffalo-Springfield Roller Company, Springfield, Ohio.

134. "Road Rollers." Illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Galion Iron Works and Manufacturing Co., Galion, O.

135. 36-page, illustrated book describing the application of Motor Rollers to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

Sand and Gravel Buckets

137. The Owen Bucket Company, Cleveland, Ohio, have available illustrated folders on Sand and Gravel Buckets showing the various types, sizes and uses for which they are intended. A complete catalog on all types of Sand and Gravel Buckets will also be furnished on request.

Sand and Gravel Washing Plants

140. Seventy-page catalog giving complete information regarding Sand and Gravel Washing Plants, stationary and portable. Those interested in such equipment should have a copy. Link-Belt Co., Chicago, Ill.

Shovels, Cranes and Excavators

146. Link-Belt Co., Chicago, Ill., has issued Book No. 1095, which describes and illustrates their complete line of Gasoline, Electric, or Diesel operated shovels, cranes and draglines.

151. Lifting capacities and working ranges for the different sizes and types of the complete line of ½-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers. Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

152. New illustrated catalogs of shovels, cranes, draglines, trenchers, skimmers, in capacities of 1¼ yd., 1 yd., ¾ yd., ⅝ yd., ½ yd., and ⅜ yd., manufactured by Byers Machine Co., Ravenna, Ohio, available for the asking.

Steel Posts

160. Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport Pa.

Surveying Instruments

163. A complete catalog and instruction book pertaining to the "Sterling" transits and levels are described and illustrated in a 64-page booklet. Warren-Knight Co., 136 No. 12th St., Philadelphia, Pa.

164. A 140-page manual of engineering and surveying instruments covering levels, plane tables, transits, current meters and supplies, such as hand levels, barometers, etc. C. L. Berger & Sons, Inc. .37 Williams St., Boston, 19, Mass.

Tires, Truck and Tractor

165. Speed and economy in use of solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Government Sales Department of the Goodyear Tire & Rubber Company, Inc., Akron, Ohio.

Tool Boxes

167. Bulletin No. G-6 issued by Littleford Bros. 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates the Han-DeeBox, a portable tool box of all-steel construction. This tool box is equipped with a special locking device that locks both covers at the same time. No padlocks are used. Littleford trailers, lead melting furnaces, and "Hot Dope" Kettles for pipe coating are also described in this bulletin.

Tractors, Crawler

169. The use of crawler tractors in roadbuilding and maintenance, earth moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes. Bulletin 562. Cletrac crawler tractors. Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, O.

171. The design, construction, details and complete specifications of the Ten and Fifteen models "Caterpillar" are given in a booklet published by the Caterpillar Tractor Co., Peoria, Ill.

172. The Caterpillar Sixty Tractor. This beautifully illustrated booklet tells the story of the Caterpillar Sixty Tractor design and construction. Caterpillar Tractor Co., Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line ranging in size from the 12 h. p. model to the powerful 100 h. p. tractor. The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio.

175. Caterpillar Tractors. The "Fifty;" the "Thirty-five;" the "Twenty-five." Full data on these models. Caterpillar Tractor Co. Peoria, Ill.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½-tons at a 10-ft. radius, for mounting on a 5-ton or 7½-ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Road and Street Maintenance

Asphalt Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

201. Full data on tar and asphalt kettles, oil burning kettles, pouring pots, torches and hand spraying attachments. Connery & Company, Inc., of Philadelphia.

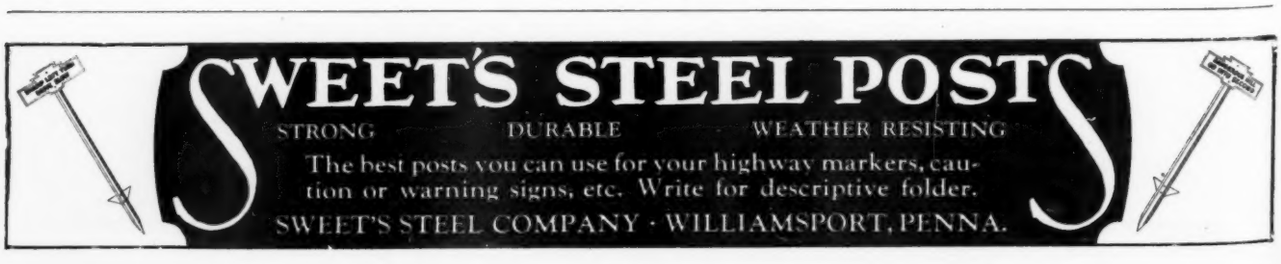
205. The latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa.

8. A 32-page general catalog issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates their complete road maintenance line, including tar and asphalt kettles, surface heaters, oil burners, sand dryers, tool boxes, lead and compound furnaces, tool heaters, asphalt tools, joint and crack fillers, squeegee carts, etc.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barberton, Ohio.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The best posts you can use for your highway markers, caution or warning signs, etc. Write for descriptive folder.
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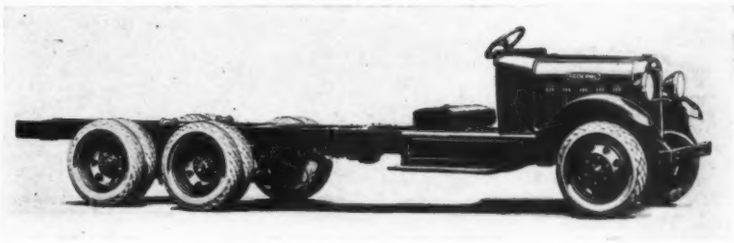
New Construction Material and Equipment

Federal 4-ton, 6-wheel Truck

The new 4-ton 6-wheel Federal truck carries a nominal rating of 4 tons and a total gross rating of 18,500 pounds. It is powered by a 6-cylinder, 7-bearing engine and is produced in two wheelbases, namely, 164" and 182", listing at $2,360 and $2,385 respectively. Six-wheel hydraulic brakes are provided, which are power-operated by vacuum booster, providing the utmost in positive braking with slight effort on the part of the driver.



Federal 4-ton, 6-wheel truck

Rust-Proofed Hose Couplings

Announcement was made recently by the Dixon Valve & Coupling Company of Philadelphia, of the rust-proofing by the electrolytic application of cadmium of their "Boss" and "Dixon" line of hose couplings.

Illustrated is the 1½" "Boss" Female Coupling with the four bolt Clamp. This type of Clamp is furnished on all sizes from 1¼" to 4", with the two bolt standard on all sizes from ¼" to 1".

Dixon Coupling

New Stabilizer for S-A Vibrating Screens

A unique stabilizer mounting for vibrator screens has been announced by Stephens-Adamson Mfg. Co. of Aurora, Ill.

In place of the usual balancing springs at the four corners of the screen a simple stabilizer unit is now mounted upon one side of the frame to hold the screen at an unchanging angle. The screen is free to vibrate with the eccentric vibrating shaft, but it resists the usual tendency to rock or swing out of the proper screening angle.

The two arms are free to swing or bend in any direction, but both must bend and swing together. In operation the movement of the stabilizer is very slight. However, it effectively prevents the annoying tendency a vibrating screen has to buck and rock when sudden loads are received.

Toledo Steel Post

This new type of post for mounting button type reflector signs is seven feet long, formed from 13 gauge steel channel section with a pressed stiffening rib. The bottom end is formed for driving into the ground or it may be set in concrete.

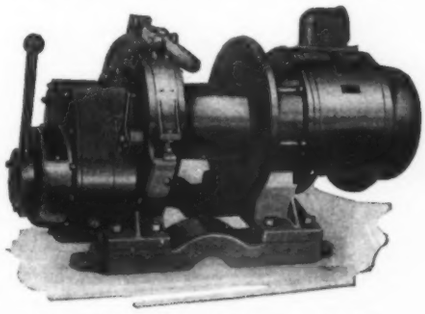
Heavy steel U-clips are welded to the post at the proper points to accommodate standard spacing of bolt holes in signs. The points of each clip project beyond the plane of the channel a sufficient distance to give clearance to the "button box" containing the reflecting portion of the sign. Thus the sign has two-point contact, is rigidly attached and suffers no distortion.

The assembled sign cannot be twisted in the ground, is strong enough to prevent its being bent permanently, but with a degree of resilience enabling it to withstand a severe blow without injury to sign or post. The new post is manufactured by The Toledo Pressed Steel Co., Toledo, Ohio.

New Electric Portable Hoist

Ingersoll-Rand Co., 11 Broadway, New York, has added to its line of portable hoists a non-reversible, single-drum electric hoist designed for many applications in the mining, contracting, and industrial fields. It is mode'ed after the company's "Utility" hoists, except that it uses an electric motor and friction clutch instead of an air motor and a jaw clutch.

The new hoist is suitable for all single cable work within its capacity, such as hoisting timbers, muck, tools, and pipe, hauling and spotting cars, and for single-line scraping. It is made in two sizes. No. 107 is of 7½ hp. and rated at 2,000 pounds pull at 125 feet per minute. It has drum capacity for 400 ft. of ½-inch or 700 ft. of ⅜-inch cable. No. 107L is of like power, but has drum capacity for 800 ft. of ½-inch or 1,400 ft. of ⅜-inch cable. No. 110 has a 10-hp. motor and is rated at 2,000 pounds pull at 165 ft. per minute. The drum capacity is the same as for the No. 107. No. 110L has the same power as the No. 110 and the same drum capacity as the No. 107L.

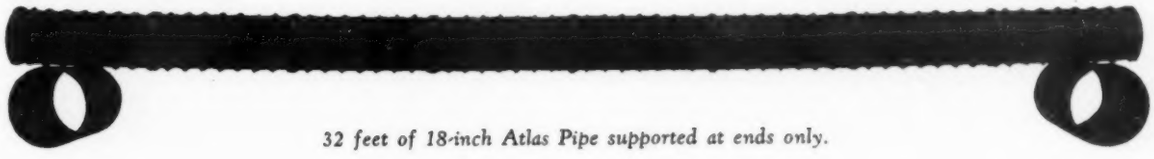


Ingersoll-Rand Single Drum Electric Portable Hoist

Atlas Cast Iron Culvert Pipe

The Alabama Pipe Co., Anniston, Ala., has developed Atlas cast iron culvert pipe, which has the new 4-lug locking joint. This assures a tight joint with perfect alignment. The illustration shows the strength of the joint and the pipe. This is made in sizes from 12 to 36 inches inside diameter, with a weight per foot of 40 to 200 pounds. The hauling and laying costs per foot, estimated under average conditions, varies from 8 cents for 12-inch pipe to 40 cents for 36-inch. Minimum strength by the A. S. T. M. 3-point bearing test is 2000 D.

This pipe is also made in lighter weights for permanent sewer installations, with the bell lugs recessed to allow for sealing the joint.



32 feet of 18-inch Atlas Pipe supported at ends only.

Dust Laying

213. Full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost. Solvay Sales Corporation, New York.

Emulsion Sprayers

214.—A complete line of emulsion sprayers is described in Bulletin No. G-5 recently issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio. Littleford Emulsion Sprayers will spray any type of asphalt emulsion used for penetration patch work or curing concrete. They are also used to spray silicate of soda and weed exterminators.

Highway Maintenance

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" describes fully the FWD truck and its economy for use in pulling road graders and maintainers—issued by Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

218. "Maintenance Machines," a 32 page booklet, tells of "Caterpillar's" complete line of maintenance machines—3 sizes of motor patrols, a trailer patrol and planer—including machines to fit all pocketbooks and all road maintenance conditons. Caterpillar Tractor Co., Peoria, Ill.

Surface Heaters

225. The "Hotstuf" three in one, combination Tool, Asphalt and Surface heater is described and its use illustrated in Bulletin 16. Mohawk Asphalt Heater Co., 56 Weaver St., Schenectady, N. Y.

Road and Paving Materials

Bituminous Materials

226. "Mixed - in - Place Construction." Step-by-step pictures and specifications for constructing road surfaces by Retread or Turnover methods. American Tar Products Co., Koppers Bldg., Pittsburgh, Pa.

227. "Asphalt for Every Purpose," a 44-page illustrated booklet describing Stanolind Asphalt products. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

228. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

Brick, Paving

230. Full information and data regarding the use of vitrified brick as a paving material, cost, method of laying, life, etc. National Paving Brick Manufacturers' Association, National Press Building, Washington, D. C.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. 47 pages. The Dow Chemical Company, Midland, Mich.

Maintenance Materials and Methods

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control.

273. Complete directions for surface treatment and bituminous surfacing with Cut Back Asphalt are contained in a 36 page data book. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road wth "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a booklet which illustrates many types o fsnow plows and methods of handling snow removal problems. Dept. B, Four Wheel Drive Auto Company, Clintonville, Wisconsin.

349. "The Answer to the Snow Removal Problem." It gives full details of the Frink type S snow plow for trucks. Carl Frink, Mfr. of Clayton, N. Y.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. The Cleveland Tractor Co., 19322 Euclid Ave. Cleveland Ohio.

354. "Snow Removal Equipment" pictures various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action. Caterpillar Tractor Co., Peoria, Ill.

355. "Conquering Snow With Caterpillars." "An Unwelcome Visitor Is Coming." "A Wall Ten Miles High." Three publications on the snow problem by the Caterpillar Tractor Co., Peoria, Ill.

358. Complete data for selecting the proper size snow plow for your particular make and model of truck. Carl H. Frink, Clayton, N. Y.

359. Galion Iron Works and Mfg. Co., Galion, Ohio. Details, prices and catalogs of their snow plows adaptable to any make of truck.

Sanitary Engineering

Activation and Aeration

390. A booklet of value to sanitary and chemical engineers describes Norton Porous Mediums of bonded fused alumina (strong chemically stable, uniformly permeable) and their use in aeration of water and sewage. Norton Co., Worcester, Mass.

Glass-Overs

393. Full details regarding the use of Lord & Burnham Glass-Covers at Dayton, Ohio; Highland Park, Ill.; Fostoria, Ohio; and Bloomington, Ill. are given in bulletins Nos. 10, 11, 14, 15. Issued by Lord & Burnham, Graybar Bldg., New York, N. Y.

Incinerators

396. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 3479 Neville Island, Pittsburgh, Pa. Booklet on request.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections. Atlas Mineral Products Company, Mertztown, Pennsylvania.

402. Full details concerning No. 1 Korite for sealing sewer pipe joints so that they will be permanently tight. Standard Oil Co. of Indiana, 910 So. Michigan Ave., Chicago, Ill.

403. An illustrated folder has just been issued by the Cochrane Chemical Co., 432 Danforth St., Jersey City, N. J., detailing the advantages and the savings in the use of Ex-XL-cell Sewer Pipe Joint Compound.

Manhole Covers and Inlets

404. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Pipe, Cast Iron

406. "Data Book"—Cast Iron Pipe and Fittings, sizes 1¼ through 12 inches, either with or without Precaulked lead joints factory-made in the bells. The McWane Cast Iron Pipe Co., Birmingham, Ala., and Provo, Utah.

407. "Handbook of Cast Iron Pipe" contains useful tables and data for the Water Works man on pipe line construction, weights and dimensions. U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe Line Construction

410. Pipe Lines and the Caterpillar. In this 32-page booklet are pictured many uses of the Caterpillar Tractor, and ways in which they can be applied to the saving of men, money and minutes. The Caterpillar Tractor Co., Peoria, Ill.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Pumps, Centrifugal

415. Design data for centrifugal pumps for high or low service pumping for waterworks and filtration plants. Dayton-Dowd Co. Mfrs. Centrifugal Pumps, Quincy, Ill.

Pumps—Sewage

417. Non-clog vertical and horizontal sewage pumps and their characteristics are described and illustrated in bulletins of the Dayton-Dowd Co., Quincy, Ill.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link Belt Company, 910 So. Michigan Ave., Chicago, Ill. Book 642.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., Chicago, Ill.

Sludge Bed Glass Covers

425. Folder, standard filling size, contains model set of specifications and 11 x 17 inch drawings showing standard sizes and construction details of King Glass Enclosures for sewage treatment plants. King Construction Co., 539 Wheatfield St., North Tonawanda, N. Y.

426. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sewer Maintenance

428. "The Expanding Root Cutter and Sewer Cleaning Method," a 32-page booklet prepared by the Expanding Sewer Machine Co., Nappanee, Ind., gives full details as to methods and equipment needed for sewer cleaning.

Sludge Treatment

430. Downes Floating Covers and Sludge Digestion Equipment. The Pacific Flush Tank Co., 136 Liberty St., New York, N. Y. Contains photographs of installations of floating covers and technical data on the subject.

Treatment

432. Eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. The Pacific Flush Tank Company of Chicago and New York.

433. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators and screens. Link Belt Co., 910 So. Michigan Ave., Chicago, Ill. and Philadelphia.

Valves

436. Data Book on Bronze and Iron Valves for service on Steam, Water, Gas, Gasoline, Air and Oil lines. The Fairbanks Company, 393 Lafayette Street, New York, N. Y.

Water Development

440. Complete details of the Layne System of water development for municipalities and irrigation projects, based on deep wells and turbine pumps. Layne & Bowler, Memphis, Tenn.

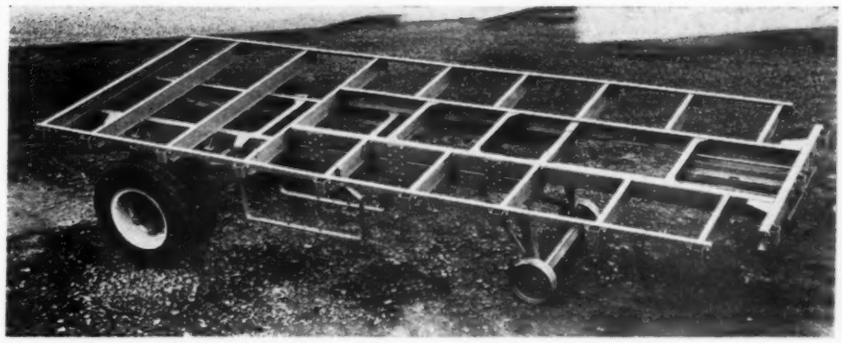
Water Storage

442. "Modern Water Storage" contains 28 pages of reliable information, interesting photographs, authentic engineering data and "Pittsburgh-Des Moines" specifications on various types of elevated tanks, penstocks, pipe lines, stand pipes, steel reservoirs, treating plants and complete water systems.

Gramm Semi-Trailers

Gramm semi-trailers are made in four sizes, with nominal tonnages of 3 to 18 tons, and maximum body and payload weight of 12,000 to 38,000 pounds. For these capacities, trailer weights are exceedingly low, due to the double channel frame construction, and the large saving in dead load results in greater net revenue. Gramm has also designed these units in "Duralumin," which results in an additional saving of 1,000 to 1,500 pounds per unit. It is believed that an operator can pay off the extra cost required for a Duralumin frame within 6 months from the extra freight revenue brought in.

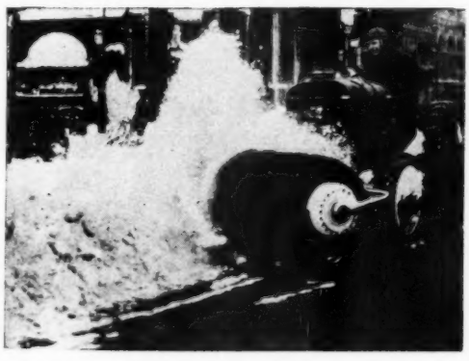
The exceedingly careful design of these units, resulting in lightness and adequate strength, open a new field for semi-trailer units. Combined with careful design is the use of many standard units. These trailers are built by Gramm Motors, Inc., Delphos, O.



Series D F Gramm trailer, with hydraulic brakes with booster, and steel platform base

Snow and Street Brushes

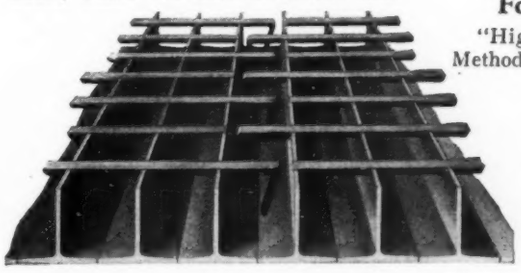
These brushes are useful for a wide variety of purposes, including street sweeping and snow removal. They can be attached easily to any of the lighter tractors, or the Ford 4-speed truck. The weight is only about 700 pounds. It sweeps a clean path 5½ feet wide, with a forward speed of 3 to 8 miles an hour, and will handle up to 6 or 8 inches of snow. If desired, the power unit can be equipped with a water tank for laying dust, when sweeping streets. The Detroit Harvester Co., Detroit, Mich., manufactures this unit.



Detroit Street Sweeper and Snow Brush

Truscon "Teegrid" for Bridge Floors

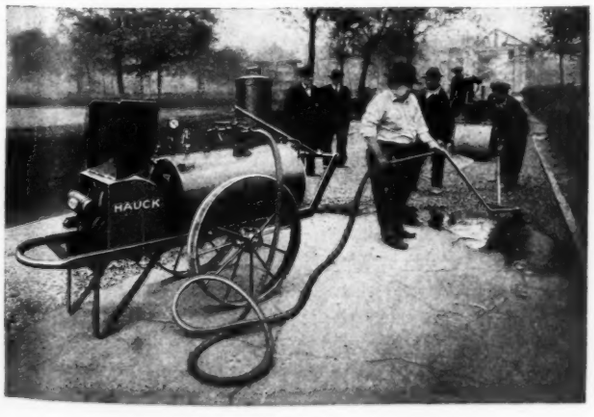
Truscon Steel Co., Youngstown, O., announce a new construction for bridge floors, which will meet the severe loading requirements necessary, while considerably reducing the total deal load. In addition to the saving in weight, there is an absolute continuity of load and material distribution, the need for field forms is eliminated and concrete can be poured at once.



Truscon construction for bridge floors

Hauck Power Emulsion Sprayer

The Hauck Manufacturing Co., Brooklyn, N. Y., has developed a pressure pump type, power sprayer for cold tar and asphalt emulsions, which has a capacity sufficient to cover 600 to 700 square yards of pavement per hour. The power unit eliminates the need for one man. A ½ h.p. combination gas engine compressor unit furnishes the power, generating pressure in the 60-gallon tank. One of the power units will do about twice the work of a hand powered unit.



Hauck Power Emulsion Sprayer

For Easy Computations

"Highway Engineering by Machine Methods" is the title of a publication which will be sent to *bona fide* engineers upon request through PUBLIC WORKS. Written in the language of the engineer, it illustrates solutions by machine of difficult problems, including "Interpolations," "The Three Point Problem," "Closing Problem and Irregular Areas."

Novo Heavy Duty Hoist

The Novo RH Hoists are built in the single, double and triple drum types, powered with 75 to 100 hp. electric motors or gasoline engines, and equipped with anti-friction bearings throughout. Power is transmitted by a quadruple one-inch pitch roller chain in a case, located on the opposite side from the operator.

These hoists have a capacity of 6 to 8 tons on a single line. They are especially adapted for such work as handling and setting steel, operating a concrete bucket, handling a high-speed material elevator and all hoisting requirements on a construction job. The triple-drum hoist with a boomswinger is used for clam-shell bucket work.

Drag line buckets and cableway excavators also can be handled with these outfits.

Novo RH Hoist

Miscellaneous

Airport Construction

595. Airports and Airways. A 20-page illustrated booklet by the Caterpillar Tractor Co., Peoria, Ill., describes the uses of tractors in building airports and handling planes.

597. "Getting on the Air Map With 'Caterpillar,'" describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Traction Co., Peoria, Ill.

Chains and Speed Reducers

607. Link-Belt Co., 910 So. Michigan Ave., Chicago, Ill., gives full description of its positive drives in books No. 125, Silent Chain; No. 1257, Roller Chain; No. 815, Herringbone Speed Reducers; No. 1050, Promal Chains. Send for these positive power transmission books.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Lufkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules, General Catalog No. 11.

Transits and Levels

629. Berger engineering and surveying instruments are described in Catalog B 140 pages. C. L. Berger & Sons, Inc., 37 Williams St. Boston, Mass.

630. Transits and Levels particularly adapted for City, County and State work are described in a 64-page catalog. Warren-Knight Co. 136 No. 12th St. Philadelphia, Pa.

Late Catalogs

Road Machinery, Etc.—Beach Mfg. Co., Charlotte, Mich., issues a catalog of "Everything used in, on or under highways," which will be sent free on request.

Graders.—Rome Mfg. Co., Rome, N. Y., has issued Bulletin 24 describing high lift drawn graders and Bulletin No. 22 covering high lift motor graders.

Sno-Plows. — Carl Frink, Clayton, N. Y., has issued a new catalog which gives a good deal of valuable information on snow removal methods and equipment. 16 pages, illustrated.

Hercules Equipment.—The Hercules Co., Marion, O., have issued Bulletins H-3112, covering road rollers, and H-3123 and H-3124, describing the Hercules Crawl Tractor. These will be sent free on request.

Paving Breakers and Pile Drivers.—Ingersoll-Rand Co., 11 Broadway, New York, has issued a new 20-page, illustrated catalogue, No. 4364, on paving breakers and pile drivers for sheet piling. It describes four sizes of paving breakers, two of which, the 37-pound L-54 and the 80-pound R-63, have been added to the line in recent months. It also contains material on two new pile drivers, the R-63 and the R-30.

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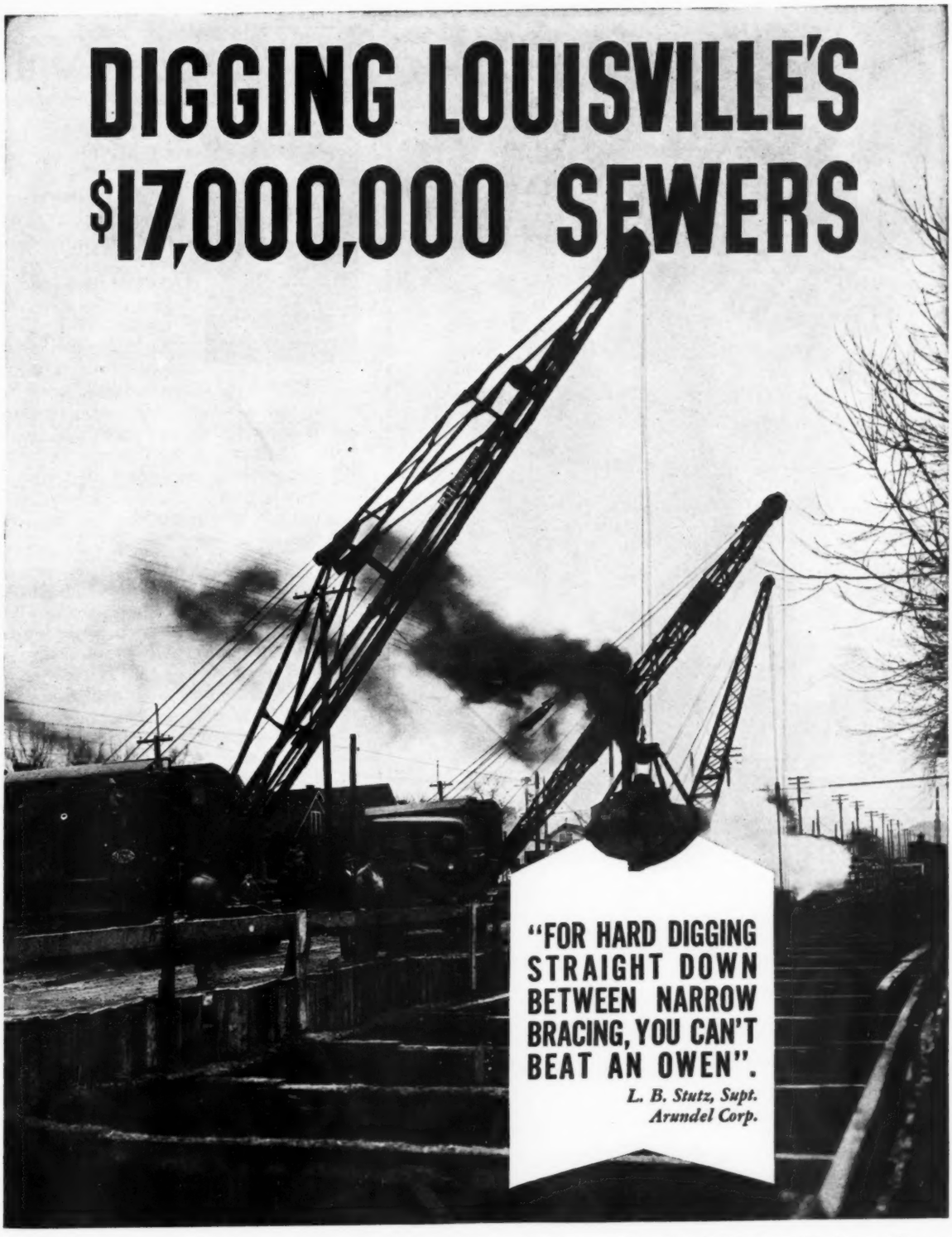
When you want catalogs describing materials or equipment advertised in PUBLIC WORKS, refer to the classified INDUSTRIAL LITERATURE section beginning on page 63 and order by number.

DIGGING LOUISVILLE'S $17,000,000 SEWERS

Owen Buckets A MOUTHFUL AT EVERY BITE



Owen Buckets are helping the City of Louisville accomplish one of the most extensive public works programs of the South. Particularly in sewer work, involving 18 major and minor contracts, Owen Buckets are conspicuously on the job digging and rehandling millions of cubic yards of earth. Contractors who have participated in this work and who are users of Owen Buckets include:

Arundel Corporation
Henry Bickel Company
Cannell-Conrad Const. Co.
A. A. Davis & Company
George M. Eady Company
Fry & Kain
J. B. McCrary Eng. Corp.
Thomas D. Nolan
Walter S. Rae
M. P. Smith Const. Company
The Torson Const. Company

To all these contractors, Owen Buckets mean time gained, money saved, and work accomplished. That's why most of the Sewer Contractors throughout the Country are *Owen Users*. That's why the list of Owen Users is increasing in every field where clamshell buckets can be employed.

THE OWEN BUCKET CO.
6012 Breakwater Ave., Cleveland

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BUFFALO-SPRINGFIELD

Travel the Lincoln or the famous "40". Take the byways as well as the highways, or the streets of our cities, large or small. The Buffalo-Springfield meets your gaze. You find them everywhere—some venerable with age and years of service—others new and of latest models.

All practical sizes, steam and motor types. Attachments, including scarifiers, optional.

The Buffalo-Springfield Roller Co.

SPRINGFIELD, OHIO

When writing, please mention PUBLIC WORKS

With Our Authors

CHARLES H. PAYNE, County Road Supervisor of McDowell County, West Va., tells of the results that have been accomplished in that county in recent years. These results are remarkable. During this period the county roads have been brought into the best conditions in their history—and at the same time the expenditures for the work have been kept within appropriations. A well-planned program, each year grading out more roads, and building more miles of pavement, has accomplished this result. Modern, improved highways will soon be available for reaching every part of the county. The methods by which these roads have been constructed at an expenditure within the reach of this county are detailed in the article.

A. JOHNSON HAWKINS has been city engineer of Birmingham, Ala., since 1921. The period since then has been marked by the solution of some of the most difficult problems that ordinarily a city engineer is called upon to handle. The elimination of grade crossings in the center of the city, the construction of a system of incinerators, and now the problem of storm drainage, which has been a bugbear for many years, have been among the most important works handled by Mr. Hawkins. In his quiet and efficient way, he has done some very constructive work for his city. Birmingham is more than fortunate to have such a man in charge of its technical work, and also fortunate in having a city commission of very able men, headed by "Jimmie" Jones, who are wise enough to follow his recommendations.

C. N. HARRUB, who tells of some of the difficulties in connection with the construction of Murfreesboro water plant, is well known in the sanitary engineering field. He was one of the first of that original group of sanitary engineers of the Public Health Service, and served with that organization throughout the war. Afterwards he became identified with B. H. Klyce, and since Mr. Klyce's death has continued as consulting engineer, with offices in Nashville.

A. R. TAYLOR, who contributed the article describing low cost street surfacing in Newport News, Va., is with the Koppers Products Co., manufacturers of Tarmac, which was used in that work.

Street Cleaning and Weed Cutting for the Unemployed.

St. Petersburg, Florida, had intended to purchase a mechanical sweeper for use on its streets, but as this would replace the services of four men, in view of the unemployment the purchase was postponed. Eight patrol sweepers using hand brooms are employed in keeping 20 miles of streets clean.

To furnish employment to additional men, about 200 are employed each week to cut weeds by hand.